TRACK TECHNIQUE

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from the desk of fred wilt

In consideration of remarks I shall make in the future, I wish to qualify the terms "athletics" and "coach" as applying only to track and field.

The article "Athletics in Russia" which appears in this issue emphasizes the training of coaches in that country. Similar emphasis on the training of coaches now exists in numerous other countries. It is therefore fitting and proper that we in America examine our position in this regard with a view to the future.

The term "professional" is applied to one who makes a business or trade of something others do for pleasure. In some countries, such as England, there are far more "amateur" coaches than professional. Most American coaches are primarily teachers who receive extra pay for their coaching duties and are, therefore, professionals.

As opposed to a craft, art, trade, or occupation, Finn (I) suggested six main criteria which typify a profession. They are (1) an intellectual technique; (2) an application of that technique to the practical affairs of man; (3) a period of long training; (4) a close-knit association of members with a high quality of communication between members; (5) a series of standards and an enforced standard of ethics; and (6) an organized body of intellectual theory constantly expanded by research.

Coaching in some countries is apparently a profession. Obviously coaching could measure up to the standard of a profession in the U.S. if we are prepared to accept the above criteria. As teachers, our coaches have undergone a long period of training in a broad academic background... although little if any specific training in basic throwing, jumping and running techniques is included in their formal education. The acquisition of technical athletics knowledge is a problem which needs further consideration. There is no series of standards in American coaching, and no series of tests to determine coaching competence. Our AAU, NCAA, NAIA, collegiate conferences, and state and national high school athletic federations cover the ethics angle admirably. However, we can claim no organized body of intellectual theory. The association and communication between coaches have not always been as close and frequent as is necessary and desirable. Considerably more research is needed in the disciplines relating to coaching, plus correlation of existing knowledge concerning athletics. Related research is so limited that, on a national scale, only a handful of people are pushing back the barriers to chart the course for future developments.

Teaching is the fundamental role of coaching. This implies (for each coach) the imperative necessity for a basic knowledge, understanding, and tactual-kinesthetic familiarity with the performance of each and every event on the track and field program in addition to a working knowledge of physiology, mechanics, and psychology. American coaches cannot afford the luxury of competence in only one event, but must coach all events. Unfortunately, some of our coaching in the past has been characterized by an alarming absence of basic athletics teaching methodology. By teaching

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methodology, I refer to the series of teaching progressions for the beginner by Frank Sharpley, currently being featured in Track Technique.

Since the USA has no residential school where coaches may learn to perform the various events, one might question where our coaches learn their knowledge of technique. Briefly, coaches in the U.S. acquire knowledge of athletics technique by (1) competitive participation; (2) trial and error; (3) reading books and periodicals; and (4) personal study, including examination of loop films.

Russia is educating specialists of all types for "export" to underdeveloped countries. Though it is not generally known, our own State Department also sends coaches to underdeveloped countries. In consideration of the elaborate system for the technical training of Russian coaches, and the lack of a system or even a school to train our coaches, the question of comparison of ability and technical knowledge logically arises.

Teachers in the USA have the academic background to become the most knowledgable and technically correct in the world. However, it is common knowledge that some have never performed or demonstrated the events they are coaching, have no kinesthetic perception of these skills, have been exposed to no athletics teaching methodology whatsoever, have no familiarity with the technical literature available, and have never participated in competitive athletics. It is obvious that the knowledge and abilities of leading coaches should be transmitted to others for the purpose of raising the general standard of technical ability among American coaches, which in turn will benefit the entire athletics picture in our country.

I respectfully suggest that leading coaches in America assume a moral obligation and responsibility for organizing and administering annually two-week summer residential coaching schools for training of coaches in the actual performance as well as in theory of each and every event. I do not mean the armchair, non-participation variety of "clinic" with which we are familiar. Let's abandon the world "clinic" as a grammatical absurdity. Most clinics are all talk and no action. Furthermore, the world "clinic" implies something antiseptic and sterile, and perhaps dead. Let's call it a school, and make it alive...a veritable beehive of jumping, throwing and running activity. I mean a full two weeks of actually throwing the javelin, discus, hammer and putting the shot, and actually getting off the ground in performing the pole vault, high jump, etc. Let's tear into it, really get in there and sweat'. Let's work'. Let's learn'. Let's invite foreign experts, and if they offer material we don't know, let's learn it and improve upon it. In short, let's establish schools similar to the British AAA Summer Coaching School (described in the 1961 National Collegiate Track Coaches Association Annual Notes, and the January, 1961 issue of the Journal of Health, Physical Education and Recreation)...only let's make them better'.

My prediction is that when such schools are operated here annually, the other criteria which typify coaching as a profession will emerge in the USA.

(I) Finn, James D., "Professionalizing the Audiovisual Field". AV Communication Review 1:9-16; Winter, 1953.

Book Review

THE PHYSIOLOGY OF MAN

(Second edition) By L. L. Langley and E. Cheraskin. 1958. Published by McGraw-Hill Book. Co. 330 W. 42nd St., New York 36, N.Y. Pp. 674. Illustrated. $6.95

This book is dedicated to the proposition that learning can be fun. Each chapter begins with a short introduction and ends with a concise summary. Inasmuch as the backgrounds of students embarking upon a study of physiology are varied, and in many cases inadequate, the first three chapters reveal sufficient basic material to provide a foundation upon which to construct a meaningful physiological stroma. Attention has been paid throughout the book to anatomical considerations, so the student may better visualize physiological function in the proper framework. The body of physiological thought has been presented in digestible units, with new facts, new mechanisms, and new concepts interwoven with antecedent material.

A New Lift for the Sprinter

by Les Mitchell, British AAA Honorary Senior Coach

It is now well-established that the use of weights is as much an integral part of the training of the sprinter as it is of the heavy field event athlete. However, it is also important to remember that weight training must not take the place of running in the schedule of work, and therefore, it becomes necessary for the athlete to select carefully from the many exercises which go to make up the usual textbook on the subject, so as to reap the maximum benefit for the minimum time expended on this aspect of his work-out.

It is also generally accepted that there is no transfer of skill from a weight lifting exercise to the performance of the actual athletic event, and the lifting schedule should concern itself solely with the strengthening of the masculature in order to provide the athlete with the basic strength, power and muscular endurance to perform the athletic skills which he will practice in his technique work on the track.

So, he may include the military or bench press and the barbell curl to strengthen the arms, and the straight arm pullover for the shoulders and chest. He may perform sit-ups for the abdominals and back, and squats, "Hack" or "Jefferson" lifts for the benefit of his quadriceps, with heel-raising for his ankles, and so on.

However, as a coach, I have experienced great difficulty in finding an exercise to help increase the knee lift of a sprinter by strengthening the hip flexors, and with this end in view I have accordingly devised the lift illustrated in the accompanying sketch.

The athlete lies prone along a vaulting horse from which one pommel has been removed and reaches overhead to grasp the other one. The slope of the horse follows the curve of his back and the height of the horse is adjusted so that his feet are just comfortably flat on the floor when wearing iron shoes. It is important that the back is well supported by the sloping end of the horse throughout the performance of the exercise. In this position, the athlete then performs high knee lifts.

It will be seen that a great deal of thigh separation is achieved in this exercise, as well as a "blowing up" of the hip flexors. If the diagram is turned side-on, it will also be observed that the performer is in a somewhat exaggerated sprinting position, thus ensuring maximum range of leg movement, as well as having to work against a resistance. Because the exercise has, in addition, a marked suppling effect, it is suggested that care be taken not to overdo the poundage lifted, particularly in the early stages. I have discussed the problem of repetitions and weight with other coaches and as a result I suggest that the exercise be performed in sets of eight, beginning with four sets and using the shoes unloaded. The weights can then be added at five pounds per shoe weekly, to a maximum consistent will a full range of movement being obtained. After this, I prefer to increase the number of sets to five, rather than to increase the number of repetitions in each set. This is, of course, only a suggestion and individual coaches will have their own ideas on the organization of the work-out. For instance, a case can be made for the quarter-miler to increase the number of repetitions while keeping the weight down, in order to place the emphasis on muscular endurance rather than on the acquisition of power. One small practical point: since there is a tendency to catch the shoes together, particularly when loaded with weights, it is easier to perform the exercise by raising one knee eight times, then the other, rather than alternately, as in a normal running action.

Returning to the contention that weight training is an adjunct to running, I would couple this exercise to long striding practice on the track, where the sprinter aims at a full range of movement, endeavoring to reach out with the thighs and knees as well as upwards.

Finally, it is clear that an exercise which benefits the sprinter will also be of great value to the hurdler who also requires a great deal of hip strength and suppleness. The high jumper, too, can gain in thigh separation by including this exercise in his weight training schedule.

How Viscosity Affects Sprinters

By Dr. Richard V. Ganslen

We are all familiar with the experience of warming-up to a job, scarcely realizing that the chief advantage of the warm-up is the decrease in internal viscose resistance of our joints and muscles. Not only does the warm-up increase the elasticity and extensibility of muscle fibres, but it also materially increases the economy of effort involved in changing our muscle fibres from elongated spindles to short thick tubes, which we often accomplish in a fraction of a second.

One of the more interesting findings in connection with this problem of internal viscosity of muscles is the fact that women Olympic runners were shown to have lower muscle viscosity than men. We can therefore largely attribute the difference in running records to differences in muscular propelling power.

Frank Wycoff is reported to have said, after an unusually fast 9.4 race of 100 yards, that he was unwilling to run faster because he was afraid that he would tear his muscles apart.

It is probably true that the viscosity of our muscles is a natural protective mechanism in man and animals and prevents serious muscular damage. There are authentic records of athletes who have ruptured their bicep muscle and broken their legs via the vigor with which they were able to contract their muscles. Many famous sprinters have expressed this same subconscious fear of tearing their muscles and it is not unlikely that those who have ignored this warning have suffered the consequences.

Dr. Ganslen is an Associate Professor of Physiology and Kinesiology, University of Arkansas.

(Reprinted from the November, 1955 issue of Sports College News).

Forward Lean in Sprinting

by H.A.L. Chapman, National Coach for Scotland

"The degree of forward lean which a sprinter should use is dependent upon two factors: (1) Wind resistance. Running into the teeth of a gale means that an athlete must lean further forward to offset the resistance produced by the headwind. The reverse effect, of course, is evident with a strong tailwind. (2) We now come to by far the most important factor - the rate of acceleration. When the rate of acceleration is at its greatest, the forward lean must be at its greatest and naturally, therefore, we find the sprinter with a tremendous forward lean at the start of his run. From the moment when he starts to the point where he reaches top speed, his rate of acceleration is gradually diminishing although, of course, his speed is increasing. (We must try and avoid getting these two things muddled). Therefore, his degree of forward lean gets less and less as he approaches top speed. At top speed, assuming that there was no wind resistance whatsoever and the athlete was running in a vacuum, there would be no lean at all. However, even if it is a perfectly calm day with no wind at all, an athlete of reasonable ability at top speed is travelling over the ground at a speed of some 22 miles per hour and is creating his own wind resistance, which will require a certain degree of forward lean to offset, although the degree of lean required is very small. In the 200 meter final at Rome, winner Livio Berutti's astonishing gyrations after running through the tape are due to the fact that he lunged at the tape. There is no question of an exaggerated forward lean throughout his run."

(Reprinted from a letter by Mr. Chapman which appeared in the May, 1961, Vol. 2, No. 3 issue of THE INTERNATIONAL ATHLETE, published in Glasgow, Scotland.)

"Now bid me run,
And I will strive with things impossible."- Julius Caesar.

Teaching Beginners to High Jump

by Frank Sharpley

(Regardless of the success enjoyed by top class high-jumpers in the U.S.A., few articles have been published in this country outlining progressive stages in teaching the fundamentals of this event. Frank Sharpley, eminent New Zealand coach, has purposely omitted many refinements and details of high-jumping important to the mature and experienced performer in presenting this article for the benefit of the raw beginner).

At take-off, to drive directly upward, not slightly forward or to the side nearer the bar. Over the bar, to get as much body weight below bar level as is possible while other parts of the body are clearing the bar, in fact to get the center of gravity as close to the bar as possible.

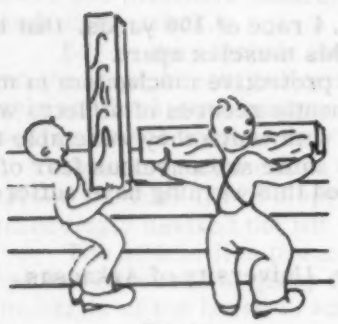


Fig. 1

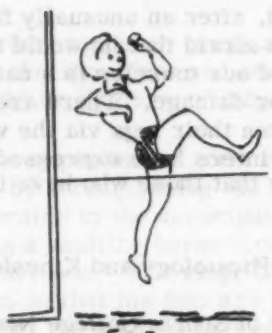


Fig. 2

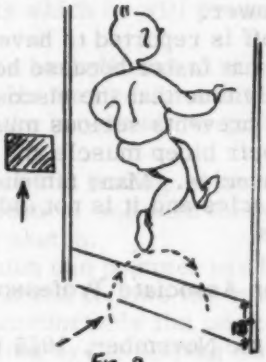


Fig. 3

Fig. 4

Consider the two men in fig. 1. The first man has to raise the tope of his post high above the fence in order to get it over, whereas the second man has to raise the top of the post no higher than the bottom. The same thing happens in high jumping. In the ordinary scissors jump that everyone does naturally, the head and shoulders must be lifted high above the bar, like the first fencepost. Western Roll and Straddle, the two usual modern styles, produce a body position along the bar like the second post.

WESTERN ROLL Learning:

1. Scissors jump from both sides of the bar to decide (fig. 2) which foot you take off from.
2. Put the bar at 2' (61cm.), jog in a few steps, directly from the front and hop over the bar, taking off from and landing on that take-off foot (fig. 3).
3. Jog from the front and hop over in the same way but this time bring the knee of the take-off leg high to touch your chest as you clear the bar, then land on your take-off foot (fig. 4).
4. Repeat 3 but this time turn in the air to land facing the same side as your take-off leg. (The drawings are for a right-foot take-off; you must turn to the left for a left-foot take-off.) (Fig. 5.)

Fig. 5

Fig. 6

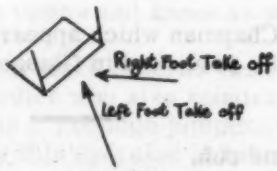


Fig. 7

Fig. 8

Fig. 9

5. Repeat 4, but put your hands to the ground as you land (fig. 6).

6. In Western Roll the approach is from the same side as the take-off leg. (Make sure you understand this before you go on.) (Fig. 7.) Repeat 6 but this time from the slight angle shown in fig. 7.

7. The beginner should run only five steps to the bar. To measure this approach stand on the spot from which you have been taking off, probably about a yard out from the bar, but facing away from the bar at the angle shown in fig. 7. Starting with your take-off leg, run loosely out seven or eight paces. A friend will tell you where the fifth pace fell.

8. Stand on this mark facing the bar, run five relaxed strides towards the bar, starting with your take-off leg, and jump as before.

9. Put the bar up to 3 or 4 feet (90 to 120cm.) according to your height. Take several jumps with a five-pace approach, working hard to get your take-off knee up to and, if possible, across your chest as you cross the bar. Fig. 8 will show you why; it is the part of you nearest the bar as you cross it.

10. Lie on the ground as in fig. 9 (opposite for a left-foot take-off) to get a picture in your mind of how you should cross the bar.

11. Jump again, this time getting your leading leg as high in front of you as you can at take-off (fig. 10). Aim to get it at least 6" (15cm) above the bar. Much of your jumping should be for a strong lead leg and for a fiercely tucked take-off leg. By this time you will find your head and shoulders become more parallel to the ground as you clear the bar. Do not emphasize this at the beginning or you will start leaning on take-off (fig. 11). Your jump should be a 1-2 movement, "one" a strong lead leg and drive up, "two" a strong tuck.

Put the bar up until you are clearing it by 5" (13cm) and jump at this height for a week before trying it higher.

Fig. 10

Fig. 11

Fig. 12

Here are some other points of style you should watch.

As you take off, both arms should be lifted, or else the arm on the same side as your take-off leg. (The boy in fig. 11 is pulling down this arm, another reason why he leans on take-off.)

When you get used to the movement, put your head down on your take-off shoulder as you cross the bar and you will soon get a horizontal position with your body. When you knock the bar off with your shoulder instead of your hip the lay-out is good.

If your legs are apart as you cross the bar tuck the toe of the take-off leg in behind the knee of the lead leg as you rise.

Increase the length of your last stride and you will be able to start your lead leg swing-up earlier and drive up more vertically.

Two heel spikes are a necessity as you improve.

STRADDLE

Straddle seems a much easier jump than Western, but is subtler and more gymnastic, and full of traps. It is easier to learn Western first and spend a year or two using that style. For many jumpers Western will always be the more efficient style.

Fig. 13

Fig. 14

Fig. 15

Fig. 16

Learning:

1. Scissors jump from both sides to decide take-off foot.

2. Try this exercise, right away from the jumping pit. Stand on your take-off leg, swing your other (or lead) leg high in front, spinning your body right round on your take-off toe to your take-off side. Drop your lead foot to the ground and raise your take-off foot bent at knee and thigh as in fig. 12.

3. Repeat, jumping as you swing up your lead leg so you do the turn and the raise of the take-off leg in the air (fig. 13).

4. Put the high jump cross-bar at 2' (61cm). Stand facing the bar and repeat No. 3 over the bar (fig. 14). Try again jogging in a few steps from directly in front of the bar. Swing the lead leg high, turn over the bar, then swing the take-off knee high and bent at a right angle. Do not kick this take-off leg straight when you cross the bar, as you may be tempted to do.

5. Repeat 4, again jogging from in front of the bar, but on take-off lift your head and shoulders high and drive up; do not crouch forward. Now raise the bar 2 inches at a time till you are clearing it by only 6" (15cm). You may want to go round to the side, the same side as you do for Western, instead swing up your leg faster. If you go to the side now you will certainly lean to the side on take-off, and this bad habit is almost impossible to get rid of later.

6. Repeat the Straddle exercise shown in fig. 12, but as you reach your high point in the air slam your head and shoulders down hard to your leading knee (fig. 15). After several tries, repeat the movement over a low bar. As you get used to this quick jack-knife, put up the bar till you can clear it comfortably by 3" (8cm). You should look as in fig. 16 but you will not be as good as this immediately. Check that only the arm on the same side as the leading leg goes over the bar, the other stays at your side or slightly behind, never over the bar like a Western Roller's arms. This movement will take some weeks to learn well.

7. Now is the time to move your run-up round. It is explained in Nos. 6, 7, and 8, Western Roll. Never run in at a sharper angle than 50 degrees when Straddling.

As you improve you will land on your back. Because of this the Straddle should not be done into a sand pit. Note that Straddle is more efficient than Western Roll because: (a) as the athlete is wider across the hips than from front to back, he can get his center of gravity closer to the bar in Straddle. (b) He can get some weight below bar level before other parts have crossed the bar (see sequence pictures 4 and 5), so lowers his center of gravity still further in relation to the bar.

TRAINING

A high jumper needs to be springy, tall, strong in stomach and legs, and supple. He can much improve the last two of these, and spring also improves with strength and jumping practice.

It is normal for jumpers to weight-train in winter, three times a week. If it is possible to go on jumping in the winter, twice or three times a week would be excellent (a pit with a single run-up is easy to make at home). A concrete path and tennis shoes work well for a run-up if your grass is too soft to jump from, though the ideal is a square yard of cinder mis at the take-off spot in front of the bar.

For the boy or girl staring training, two weeks of Fartlek (speed-play) should be done if you are already fit from previous sports, or three weeks if unfit. For the next two weeks two Fartlek sessions and two on interval running will build a background of fitness for you. Then jumping

begins. Early in the season training should be heavier, concentrated on getting the movement right; later training can be lighter, with more competition.

Here is a possible schedule during competitive season for the beginner:

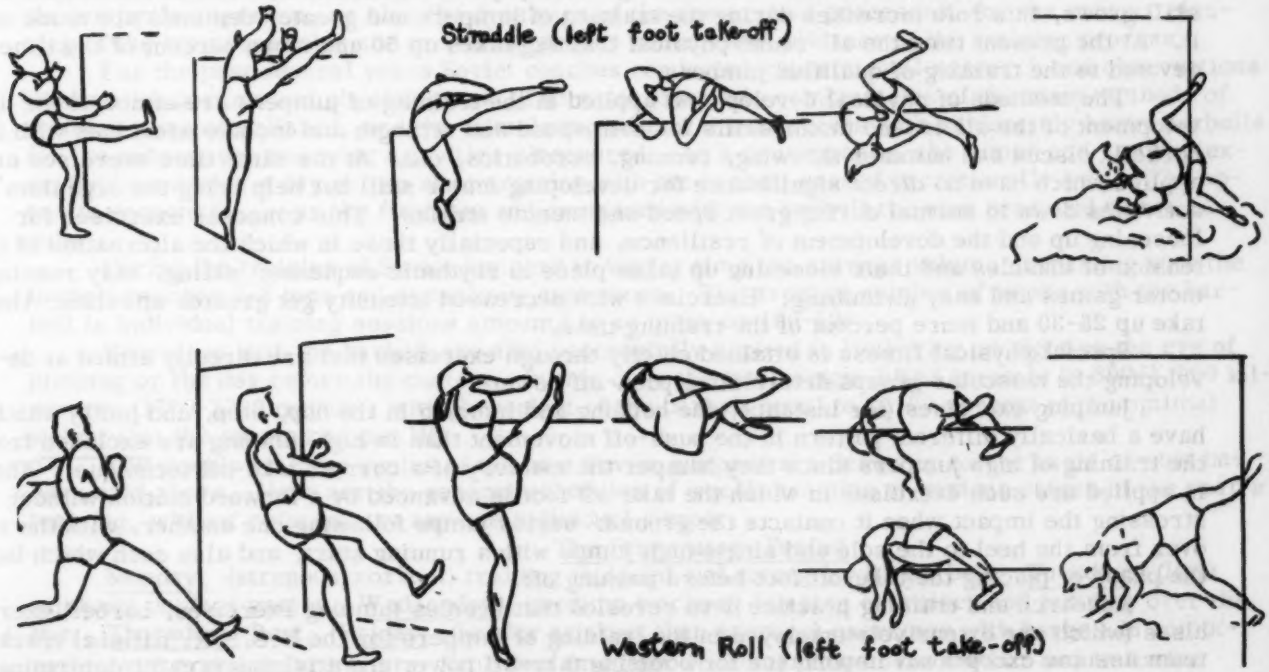
Monday and Wednesday: Warm-up, including running over hurdles and suppling exercises. Put the bar at 4' (122cm) and hop over three times, aiming at driving straight up. Run straight from the front. Two more hops with the bar as high as possible. Measure your approach run with a steel tape. Three jumps at a comfortable height, just to loosen out. Increase the bar 2" (5cm) at a time till you fail twice. Rest. Raise the bar 2" higher than you failed at. Make three full-scale attempts to clear this, to get used to the height, and to check what part of you is fouling the bar (Don't think 'That's impossible'; think 'Let's have a go at it'.). With the bar at a height you can clear most of the time, try six jumps for your main fault. It may be 'stronger lead leg', or 'start your lead leg sooner', or 'no lean on take-off' (try your head on your lead-leg shoulder during run-up to remedy this), or 'head down over the bar'. Each jump must be clearly thought out beforehand, and post-mortemed afterwards. But do not 'concentrate with your body', as it were, when you actually jump, or you will tighten up. And never just 'have a few jumps' without purpose. Finish with three times 220 yards with three minutes rest between, at whatever best speed you can run not one but the three of them in. Finally, warmdown.

Tuesday: Warm-up, with hurdling exercises and high kicks. Hops as on Monday. Measure your approach. Two jumps to loosen out. Twenty-four jumps to improve your main fault. Do them in groups of four, with a rest between. The height will depend on the fault; 'tucked take-off leg' in Western is best done at a high height; ' smooth run-up with long last stride' is best done at a height you can clear comfortably. Six runs for speed over five high hurdles, against a watch if possible.

Thursday: Same as Tuesday, but with only 16 jumps. Spend half an hour on your next best event. High jumpers are most usually long jumpers, hurdlers, or even javelin throwers.

Saturday: Competition. If there is no competition run a height trial for yourself, starting as high as you dare and going up, with a rest between jumps, through whatever sequence of heights you like best till you reach your previous best height on your fifth or sixth jump. If you do, then raise the bar an inch. When you fail three times at any height, stop altogether, and do half-hour Fartlek if convenient.

(The above article was reprinted from the booklet entitled "ATHLETICS, a guide book for teachers, coaches and players," by specific permission of its author, Frank Sharpley.)



Problems Involved in the Training of Soviet High Jumpers

by Vladimir Dyachkov, Russian High Jump Coach

In this article I shall try to give you an idea of the general principles that underlie the planning and organization of the training of high jumpers in the U.S.S.R., without dwelling on the problems pertaining to the training of specific Soviet athletes.

The methods for training high jumpers were involved in the Soviet Union on the basis of the general principles of the Soviet system of training, the data supplied by physiology, psychology, biomechanics, and other sciences, the generalization of experience of the best foreign and Soviet jumpers and, finally, on the basis of the investigations and experiments regularly conducted in the process of training jumpers for the U.S.S.R. national track team.

The process of physical training, conducted in close unity with the perfection of jumping technique and the formation of special motor habits, has become the leading factor in the training of jumpers.

In arranging the training process, we are guided by the need for a careful approach towards the jumper's nervous system so that it should strengthen, and his neural energy accumulate, while his physical qualities develop.

The complex research into the influence exerted by various training strains on the sportsman's organism revealed the following:

The greatest fatigue of the central nervous system is caused by high jumps, especially at great heights. The result is that the functional condition of the neuro-muscular machinery right after intensive high jumps considerably deteriorates. Two or three days are required for its recovery. Less noticeable changes take place in the central nervous system under the influence of exercises with a barbell. The recovery of the organism's capacity for work sets in faster.

The explanation for this is that jumps over the bar make greater demands on the main neural processes. The successful accomplishment of the jump, expecially at great height, requires an exceptionally high concentration of neural processes in the cortical department of the motor analyzer. At the same time it is known that the cortical nerve cells get tired quickly. Therefore, to avoid overstraining the jumper's nervous system while ensuring the necessary high quality workouts, the main emphasis in training is made on additional exercises.

Various methods for all-round physical development are used for the training of jumpers. Despite the established belief that the role of general physical fitness decreases as the athlete's skill grows, this role increases during the training of jumpers and greater demands are made on it. At the present time the all-round physical training takes up 50 and more percent of the time devoted to the training of qualified jumpers.

The methods of physical development applied in the training of jumpers are aimed at the development of the all around motor skills for both speed and strength and include exercises with the barbell, discus and hammer throwing, running, acrobatics, etc. At the same time exercises are applied which have no direct significance for developing motor skill but help bring the organism's activities down to normal during great speed and muscle strains. This concerns exercises for loosening up and the development of resilience, and especially those in which the alternation of the tension of muscles and their loosening up takes place in rhythmic sequence: skiing, easy running, motor games and easy swimming. Exercises with decreased intensity get greater attention: they take up 25-30 and more percent of the training time.

Special physical fitness is attained chiefly through exercises that are directly aimed at developing the muscular groups determining push-off power.

Jumping exercises (for instance, the hopping and jumping in the hop, step, and jump) which have a basically different pattern in the push-off movement than in high jumping are excluded from the training of high jumpers since they hamper the mastery of a correct take-off technique. What is applied are such exercises in which the take-off foot is advanced by a forward motion without stressing the impact when it contacts the ground: series jumps following one another, with the roll-over from the heel to the sole and single high jumps with a running start, and also such which lack the phase of placing the take-off foot before pushing off.

Research and training practice have revealed that besides jumping exercises, barbell exercises (which are extensively employed in the training of jumpers for the U.S.S.R. national track team assume exceptional importance for boosting take-off power and attaining greater determination.

Preference is given to rapid movements: jerks and snatches. The training sessions are conducted mainly with weights equal to 70-85 percent of the optimal weight that the athlete can lift. Periodically the optimal weight is lifted, as a rule once a week in the preparatory period (while not more than once in two weeks in the competitive season). The number of lifts amounts to 3-4 in the case of light weights, dropping to 1-2 lifts with the increase in the weight of the barbell.

There are four types of exercises with heavy weights: squatting with a heavy weight (110-150 kilograms, 242-330 pounds), jumping up and squatting with lesser weights (80-90 kilograms, 88-176 pounds), and down with the knee joints slightly bent (40-80 kilograms, 220-286 pounds) and rising on the toes and jumping on the toes (100-130 kilograms, 220-286 pounds).

The greatest amount of exercise falls to the third group: springy jumping up and down with the knee joints slightly bent. In doing so the weights and the conditions for fulfilling these exercises change: the speed of jumping up and down, the angle at which the knee joint is bent. This is done so as to prevent the rapid adaptation of the jumper's organism to the repeated conditions for fulfilling the exercises and to the strains, which could deter the further development of the muscles of the jumper's balance and motor machinery.

The weight of the barbell is equal to about half of the optimal weight the sportsman can lift while rising from a deep squat. Gradually the weight of the barbell is increased up to the middle of the winter stage of the preparatory period. Then with the approach of spring, starting about in the second half of February, the weight of the barbell is somewhat decreased, and what is chiefly applied is exercises in jumping up and down with the barbell.

Various weights are employed and the conditions of the exercises are changed at one and the same training session. Jumps with the barbell are combined with rapid jumping exercises without the barbell, with stretching and loosening up exercises, and also different kinds of racing, especially sprints.

What is the role of the jumps over the bar in the training process? In recent years their role has considerably decreased: they take up 12-16 percent of the total training and amount to an average of 1,200-1,300 jumps a year. At the same time a set of imitative exercises imitating high-jump movements which the jumpers fulfill at every training session for the purpose of polishing up on precision and the automatic movements is broadly applied for perfecting jumping rechnique.

The training cycles are the main links through which a definite system of moulding the athlete's organism by various means of training is implemented.

It is necessary to know the character of the main exercises and to what extent they influence the jumper's organism, as also the dynamics of the restorative processes, for the correct planning of the training cycles and providing proper control and guidance of the training process.

For the past several years Soviet coaches conducted experimental research and observations jointly with doctors and physiologists. The more favorable combinations of the main methods of training were established, and the stimulating role of the exercises with moderately heavy barbells for the subsequent muscular activities discovered. As a consequence, the jumps and jumping exercises conducted a day or two after training with the barbell passed exceptionally well. The opposite sequence: jumps the first day and exercises with the barbell the next produced worse results.

During the training of Soviet jumpers in winter time the average volume of training with the barbell reaches 2-3 tons and sometimes even more. The average number of jumps with the barbell in individual training sessions amounts to as many as 100-120.

Exercises with the barbell are also successfully applied in limbering up right on the eve of jumping or the day before the contest. In this case the total weight lifted amounts to 800-1,000 kilograms (1760-2200 pounds), with the weight of the barbell equal to 65-70 percent of the optimal weight that the sportsman can lift.

The weekly training cycles of the best Soviet jumpers are drawn up on the basis of what has been said above. Here are the general schedules of weekly training at various stages of the year's training, without reference to any one individual jumper.

The Preparatory Period

Monday: (strenous workout) training in speed and strength with barbell. Tuesday: (light workout) outdoor games. Wednesday: (medium workout) jumping exercises and jumping over the bar. Thursday: Rest. Friday: (harder workout than average) exercises with barbell in combination with training for sprints. Saturday: (medium workout) jumps over the bar and imitative

exercises. Sunday: Rest.

In the Period of Competition
(The Week Between Competition)

Monday: (strenuous workout) jumps over the bar at a moderate height. Tuesday: (average workout) exercises with the barbell in combination with cross-country runs, Wednesday: Outdoor limbering up exercises. Thursday: Rest. Friday: Exercises with the barbell. Saturday: Jumps over the bar, raising the bar gradually until it reaches near the top or the top heights. Sunday: Rest.

The schedule for the week preceding competition differs from that given above in that Monday's workout is decreased to above the average; on Tuesday--limbering-up exercises out in the open air instead of barbell exercises; on Wednesday and Thursday--complete rest; on Friday--barbell exercises are retained in combination with easy runs; on Saturday -- the contest.

In the training of jumpers the training cycles offered above are to be used creatively, taking into account the individual features of every athlete, the time he has been in training, the organism's adaptability to the various strains, his physical and technical preparedness, his living and working conditions, etc.

The individualization of the training is conducted on the basis of a thorough pedagogical and medico-physiological control over the entire course of the training process.

How They Train

by Fred Wilt

DYROL JAY BURLESON, Cottage Grove, Oregon High School, and the University of Oregon, age 21.

BEST MARKS: Mile, 3:57.6; 1500 meters, 3:40.9; 880 yds., 1:48.7; 440 yds., 47.6 (relay):

BORN April 27, 1940 at Cottage Grove, Oregon, 6'1" (1.85m), 155 lbs., (70kg) started racing in 1954 at age 14.

PRE-RACE WARMUP: Jog one mile. Calisthenics. 2x220 yds. at racing pace. Walk and jog until race.

PRE-TRAINING WARMUP: Jog one mile, followed by calisthenics.

PRE-COMPETITIVE SEASON TRAINING: At the conclusion of the competitive season in June or July, in the absence of trips for foreign competition, Dyrol rests from competition until Sept., at which time he starts running cross-country and continues this throughout the Fall. Then his training switches to the track.

Monday: 4x440 yds. in 70 seconds. Jog 220 to 440 yds. after each. Walk ½ to 1½ miles. Repeat 4x440 yds. in 70. Walk ½ to 1½ miles. Then 2x660 yds. in 1:45. Jog 660 yds. between. Tuesday and Thursday: One hour of light speed play, including much jogging, some walking and 50-300 yds. sprints, the number depending upon personal inclination. Wednesday: 4x330 yds. in 50 sec. Jog 110 yds. to 220 yds. after each. Walk ½ to 1½ miles. Repeat 4x330 yds. in 50. Again walk ½ to 1½ miles. 4x220 yds. in 35 seconds each. Jog 220 yds. after each. Friday: Rest or jog 2 miles. Saturday: Time trial or competition. Sunday: Jog 2 miles.

During competitive season, Dyrol's training remains essentially the same as during pre-competitive training, with respect to number and distance of repetitions, recovery jogging between repetitions, and with respect to his speed-play workouts. However, his training speed progresses to 59 sec. for 440 yds., 42-45 sec. for 330 yds., and 29-30 sec. for 220 yds. Occasionally Dyrol jogs two miles easily at 8:00 AM. His workouts normally begin at 3:00 PM daily, and usually require one to two hours to complete. He participates in 3-4 cross-country races, two indoor races, and 8-10 outdoor track races annually. He uses a limited amount of training with light weights, and occasionally swims after hard workouts. He was coached by Wallace Ciochetti and Sam Bell while in high school, and established a National High School mile record of 4:13.2. Now coached by Bill Bowerman, Burleson captured the NCAA mile in 1960 and 1961, placed sixth in the 1960 Olympics with a U.S. record 3:40.9 and won the AAU in 1959 and 1961. He never races against the clock and prefers to follow the opposition and finish strongly over the final 440 yds. The best has not been seen from this youthful champion, and his speed over 440 yds. is strong evidence of his great potential.

How They Train

by Fred Wilt

TOM SULLIVAN, St. George High School (Evanston, Illinois) and the University of Chicago Track Club, age 18.

BEST MARKS: 4 miles, 20:39; 2 miles, 9:29; mile, 4:03.5; 1500 meters, 3:48.0; 3/4 mile, 3:00.9; 1000 yards, 2:10.5; 880 yards, 1:50.6; 660 yards, 1:19.3; 440 yards, 49.4 (relay); 100 yards, 10.6.

BORN January 17, 1943 at Chicago, Illinois, 5'8" (1.73m), 135 pounds (61 kg.), started racing in 1957 at age 14.

PRE-RACE WARMUP: Jog 1¼ miles. 8-10 minutes calisthenics. 4-5 x 50-60 yards acceleration sprints. Walk briefly between.

PRE-TRAINING WARMUP: Jog 1½ miles. 15 minutes calisthenics.

CROSS COUNTRY TRAINING: (August 1 to November 25, 1960). Jog 3-5 miles daily throughout August.

September: Monday: 5 miles cross country at 6 minutes per mile. Tuesday: 12 x 440 in 75 sec. Jog 440 in 2½ mins. between. Wednesday and Friday: One hour Fartlek. Thursday: 12 x 220 in 32 sec. Jog 220 in 1½ min. between. Saturday: 45 min. running over hills and through sand. Sunday: rest.

October: Monday: 4 x 1 mile in 5:15. Jog 880 in 8 min between. Tuesday: 15 x 440 in 75 sec. Jog 440 in 2:15 between. Wednesday and Friday: One hour Fartlek. Thursday: 20 x 220 in 35 sec. Jog 220 in 60 sec. between. Saturday: 45 min. running over hills and through sand. Sunday: rest.

Sullivan runs Fartlek (speed-play) thus: 10 min. easy running. 1½-2 miles at steady speed. Walk 5 min. 4 x 440 at fast pace, jog 440 between. Mile at easy speed, with many 30-40 yards acceleration type sprints enroute.

INDOOR RACING TRAINING: (January, 1961) Monday: 8 x 440 in 65 sec. Jog 440 in 2:15 between. Tuesday: 6 x 330 in 42. Jog 440 in 2 min. between. Then 8 x 50 yds. sprints. Jog 70 yards between. Wednesday: 2 x 3/4 miles in 3:20. Jog and walk 10 min. between. Thursday: 20 x 110 in 14 sec. Jog 110 in 45 sec. between. Friday and Sunday: rest. Saturday: race.

While in high school Sullivan's track season started annually with indoor racing in December and continued through outdoor track season which ended in June. He never trained more than once daily. Duration of workouts--90 min. each, starting at 3:30 p.m. He last ate 4 hours prior to competition. He participated in 12 cross country, 10 indoor and 10 outdoor races annually. He rested 1 to 3 days prior to competition. His tactics include leading or following, according to the ability of his competitors, but he prefers to follow and kick late against better opposition. Weight training was used only occasionally. He rests 4 weeks during the summer prior to beginning his cross country training. Sullivan holds the world junior (under 19) mile mark at 4:03.5, a record formerly held by Herb Elliott at 4:04.4.

Sullivan gratefully acknowledges that much of the credit for his success should be given his excellent coach, Don Amidei. Possessed of a keen mind and fighting spirit, the best is yet to be seen from this personable and popular youthful champion.

Proving Women's Stamina

"Your readers should be aware that it is on record that four women have actually completed the South African Comrades' Marathon. This race has been described as the most arduous race in the world, not just because of its 54 miles length, which some consider nothing, but because of the intense heat the runners have to face and the mountainous nature of a course more than twice the distance of a marathon." by Miss Dale S. Greig, age 24, 1960 women's cross-country champion of Scotland, who has completed many 20 mile runs and a 30 mile run on one occasion.

(Reprinted from a letter by Miss Greig which appeared in the May, 1961, Vol. 2, No. 3 issue of THE INTERNATIONAL ATHLETE, published in Glasgow, Scotland.)

Athletics in Russia

by Kalevi Rompotti - Finland

Before the Second World War little was known in other countries about athletics in the USSR. It is true that after the revolution great interest was aroused in mass sport. Top athletic performances remained far to the background because it was considered a bad occidental demoralization. But after World War II an interesting upheaval occured. After the national spirit awakened, top sport performances suddenly were pushed to the front with an unexpected emphasis. Soon after the war a considerable number of curious and studious experts, spectators, coaches, and sportsmen were sent from Russia to become acquainted with the other world's sport activity. The results were seen in the Olympic Games at Helsinki in 1952 when the USSR took part in the Olympic Games for the first time since the year 1912.

What is the reason for the rapid rise of USSR sport? The highest authority in USSR sport, the committee of physical culture in the government, set an undisguised objective for the athletes- world records in every event for the USSR and its communistic party. Since then, this goal has been sought firmly, tenaciously, and systematically

In the USSR the most popular sports are track and field, $3\frac{1}{2}$ million athletes; volley ball, 2.6 million players; at least as many football (soccer players); $2\frac{1}{2}$ million skiiers; and about one million gymnasts.

Choice and selection of the athletes begins in the lower grades of the 10 years school. During school hours only 2-3 hours per week are used for sport, but after school each day the pupils have an opportunity to participate, with the best of their physical education teachers, in the activity of various sport clubs. The best boys and girls are enrolled in the sport schools for training in the evenings. In Leningrad there are 22 sport schools where 13,500 young people are in athletic training. There are 1,000 such clubs or centers for juniors and 180 for seniors in the USSR. All together these training centers have about 300,000 boys and girls of higher potential in regular training. Pupils are divided into three groups. The medium potential young athletes train three times a week, 1-2 hours per workout. The sport masters of the schools are trained five evenings per week, three hours each workout. In the summer this program is completed with month-long camps ("Pioneer" Camps). Twice per year these pupils are given medical examinations.

The most talented young athletes who have at least a medium school education are usually enrolled in the sport institutes which prepare sport teachers and coaches for schools, clubs, factories, collective farms, etc., each of which has its own sport organization. The education of coaches generally covers four years. The education of the teachers and coaches for the sport institutes and universities covers five years including some definite research work.

These sport institutes, (which correspond to university institutes), also include a two-year "trainer school" course, the entrance qualification to which is a top result in some sport event. It is interesting to note that in the "trainer school"of Leningrad's sport institute there are today 200 pupils (athletes). There are a total of 16 higher educational sports establishements with 10,000 students in the USSR. Probably the majority of the rising stars attend these institutes, where very important scientific research in sport is also conducted.

My recent tour in the USSR made it clear to me where the great ability of the Russian woman is hidden in many athletic events. In sport and physical education, boys and girls, women and men, are all educated together; both at schools and in the institutes. This educationally and athletically most interesting method is an outcome of many long lasting unprejudiced experiments which culminated only four years ago. When I asked the reason for such co-education I received this answer: "Man and woman are created to love and work together. It is most natural that they participate together in athletics as well." Apparently the woman profits by this co-operation where her power and abilities are developed with masculine training methods. When, for example, the push up is included in the exercise program, the girls are allowed to finish earlier than the boys, but the strongest girls try to keep up with the boys as long as possible. In the medium schools until the eighth grade boys and girls do the gymnastics with apparatus together also. In all sport events the demands are made less difficult on the women of course, inasmuch as they use lighter instruments etc. However, women do not compete against men in competittion. When the training takes place at the same time in the same gymnasium and on the same tracks and fields, the men offer good technical examples

and the women by their presence at workouts spur the men to try to do their best. Therefore, an effective and profitable atmosphere for training is created.

A remarkable part of the USSR top sport activity is concentrated in the Red Army. One of the best known stars of the armed forces was the 10,000 m world record man, Vladimir Kuts. The Russians reason that the armed forces exist for the people and although top sport performances are not always in accordance with the best interests of army duty, it is in accordance with the best interests of the country, in which case the armed forces must yield. Thus a top star in the USSR can live comfortably without occupational worries and under scientific coaching prepare for international competition and assaults on the world record, which are their ultimate objectives.

The greatest athletic victories are rewarded by the state with decorations and various "master" titles and also with monetary prizes. When we recognize that the USSR selects the best athletic material more carefully than any other western country (with the possible exception of the U.S.A.), it is obvious as to the reason for the excellent athletic performances and records of Russian athletes.

Actually when we understand this athletic background, the many recent defeats of the Russians are astonishing. Examples are the poor performances of the USSR in the European track and field championships in 1958, and in the world football championships the same year, defeats in country matches against England in football and Germany in track and field, etc.

Do the USSR athletes feel their responsibility too heavily? One may consistently establish how the western athletes, whose attitude to sport is more game-like and therefore more stimulating mentally, usually win in the equally matched competition against the Russian athletes, who are pressed by their deep sense of responsibility.

But the sport of the USSR has many other duties, in addition to the mere advertising of the country and its social system, or the proving of the peoples physical power. It was very interesting to note how every sport and physical education lesson, both in the schools and in the institutes, begins with quite military like ceremonies. The pupils are on duty - boys as well as girls - standing at attention in proper order when the teacher comes in. Then the orderly or lead pupil marches forward with precise steps, turns in front of the teacher, and makes an attendance report while the others stand at stiff attention. After this the teacher salutes the class, which answers simultaneously, "Good morning".

In observing the military photos decorating walls in the corridors of the schools and institutes, the wall paintings in the sport institutes of Leningrad, and in inspecting hand grenades belonging to the sport equipment of the schools, one can readily recognize that nowhere else has the physical education been used so widely for military readiness. This part of the USSR sport was symbolized strikingly by a great light statue in Moscow in one park in front of the entrance of the Lenin sport institute - this statue representing a woman casting a hand grenade.

The subjects studied in the sport institutes of Russia are nearly identical to those of the Physical Education institute of Helsinki University, with one exception: The first subjects studied there were philosophy, political economics (Marxism, Leninism) and political history of economics. Political ideology joins firmly to the physical education there. Only where one party reigns is this natural and possible.

The aims of sport in USSR are clear, much clearer than those of western sport. Their object is to maintain and develop occupational health and battle readiness of the entire population. Mass sport may be one way to retain the political unity of the USSR, while superior athletic performances attempt to show the strength of the prevalent social order and to raise national self-confidence.

Sport and physical education in the USSR has been assigned great and exact tasks. I feel that here sport in the USSR differs most with that of the western countries. Sport in the USSR is strongly supported by the state and very much appreciated in every society level.

The most striking contrast to sport in the USSR is to be found in another mighty country, the U.S.A. Sport there is fundamentally an idea of the harmless joy of a relaxed yankee boy at play, while USSR sport is more conscious of its aims, and strictly regimented with solemn faced determination. I feel that here lies the power and weakness of sport as it is known in Russia today.

"Still as they run they look behind,
They hear a voice in every wind,
And snatch a fearful joy." - Gray, Ode On A Distant Prospect of Eton College

Psychological "Tune-Up" of the Athlete

by A. Yegorov, Leningrad Institute of Physical Culture (Lesgaft)

In N.G. Ozolin's brochure "Training the Athlete's Moral and Will Power" (Phys. Culture and Sport, 1958), a series of athletic cases is presented which brings out the idea that the athlete's thoughts concerning the possible undesirable consequences of his actions constitute a negative influence on his success in competition. On the other hand, the athlete's belief in success has a favorable influence on his actions and results. In relation to this, Ozolin writes: "The athlete should never, in training or in competition, allow his thoughts to dwell on his fatique, and should not talk himself into failing to fulfill the task he has set. To suggest to oneself that one can cover the distance faster and to believe firmly in this will make the task easier and will actually bring about its fulfillment." (Ibid, p. 29)

However, some questions arise: to what extent are these facts typical (they were indeed isolated cases), how do thoughts influence the athlete's activities when other factors are acting upon him, how important is this influence and how can its mechanism be scientifically explained? Unfortunately, a direct answer to these questions cannot be found in the theoretical literature nor even in the practical literature. Nevertheless, their solution has an important significance in relation to developing the ability to consciously overcome difficulties.

With the aim in mind of explaining these questions, we conducted a special investigation during the summer of 1959 on athletics of the Leningrad team, mainly distance runners, middle distance runners and walkers. Theoretical considerations for the investigation and for the interpretation of collected data were taken from two papers dealing with the signal funcion of psychics: a study by I.M. Sechienov on the regulative role of consciousness, and a study by I.P. Pavlov on the conditioned reflex activity of the cortex of large cerebral hemispheres. Briefly, this theoretical background is as follows.

As is known, the most complex and delicate interaction of the human organism with its environment occurs in the action of the cortex of the brains' large hemispheres which, according to Pavlov, are analytic-synthetic, signal (by way of significance), and locking (by way of mechanism). The analytic-synthetic activity of the cortex consists of reflecting (after a distinguishing and summarization) the irritants that act on the brain; the signal sets up a preventive to irritants which are indicative of changes in the organism's outer and inner environment and which demand definite answering reactions. The distinguishing, summarization and setting up of precautionary (signal) signs of irritants takes place during a locking of the temporary nerve connections. As a result of this locking, the organism reacts in some way to the irritant. Pavlov reckoned that a given reaction by the cortex is simultaneously both physiologic and psychic.

From this it follows that the psychic processes (sensations, perceptions, thoughts, etc.), being analytic-synthetic reflections of irritants and their signal meanings, have a regulative role and determine one or another kind of reaction of the organism, since there simultaneously occurs a moment of locking of the temporary nerve connections and a moment when the effect of the irritant is transferred from sensory cells to effective cells. Psychic activity is reflection not only of present but also of past and future activity. Therefore, a person is influenced by past experience along with expected changes of conditions and of results of activity, in addition ot current realities.

The amount of signal influence of the objective conditions of present, past and future activities on the individual is determined by all of the above, and these conditions are reflected in his perceptions, performances, thoughts and feelings. The primary effect on a person's behavior and actions depends on which aspects of reality (favorable or unfavorable aspects) make up his thought content.

In the light of these theoretical considerations, let us first examine a set of facts which characterize the relationship of a definite line of thinking of an athlete to the appearance of a certain type of pre-race condition and to the overcoming of such conditions. Facts obtained by observation and by conversation with athletes indicate that when certain kinds of pre-race conditions appear in an athlete, the trend of his thoughts (along with such factors as health status, training, weather, opponents, etc.) is of vital importance.

Thus, for example, a 5000 meter runner on the day before the 2nd Spartakiad of USSR nations came down with starting fever (very agitated; a feeling of uncertainty). As it turned out after talk-

ing with him, the thoughts prevailing in his consciousness at that moment were thoughts of unfavorable situations, e.g. a failure of his running technique (he had recently transferred from the middle distances to longer ones), a change in the training regime in connection with foreign trips, and the excellent condition of his chief opponent. If we take into account the excellent weather, the good physical health of this runner, the lack of any heavy burden and of the influence of any other unfavorable factors on that day, then it becomes evident that the starting fever was directly related to the fixations of thoughts on unfavorable circumstances. And all of this in spite of the fact that he was in excellent athletic form and had an advantage over his opponent as far as speed is concerned. The runner lost the race. Evaluating his performance afterward, he stated that he let his chances for victory slip away when he gave the initiative to his opponent near the finish, being unable to overcome his pre-race feelings of uncertainty.

This same athlete, prior to the all-union cross-country race in the fall of 1959, felt completely ready (easy breathing, self-confidence). After running the full racing distance with accelerations before the race, he felt no weariness. The runner was reminded of promises he had made to his study group to try to finish first, and he knew the main contenders for victory were not in good enough shape. His thoughts centered, therefore, on favorable, mobilizing factors although he was not especially trained for cross country). As a result he was able to mobilize his capabilities superbly and win the race.

Here is another fact. Prior to the Leningrad-Belgrade track meet in 1959 one of our leading marathoners experienced a state of starting fever. He couldn't rid himself of the idea that, even though competing at a distance that was not his specialty (he was a 5000 meter man), without special preparation (other than a recent time trial over 20 kilometers, about $12\frac{1}{2}$ miles), he was obligated to take first or second place in a race against athletes who specialized at this distance. From the start of the race he was unable to overcome the agitated condition resulting from these thoughts, and because of this he was unable to realize his possibilities in the race, where he finished fourth.

On the other hand, before the international marathon in Kosice, Czechoslovakia, this athlete knew that he was very well prepared for the race, he felt excellent, and was confident of victory, taking into account the past performance of his main opponents. This, by his own words, helped him to realize his capabilities and take first place.

Another example. Before the start of an international meet one of our sprinters experienced a starting apathy. Depressed because of the heat, he thought only of the idea that in such conditions it was impossible to run a good race, and he wanted to get the whole thing over with as soon as possible. In the race he finished fourth. Prior to the start of the USSR-Germany meet in 1959 this same athlete was ready for battle, and in spite of the fact that he felt badly and was weak from travel sickness, he thought only that he had to win at all costs. Such thinking, according to his testimony, enabled him to mobilize himself and compete successfully.

The main idea in all of these example is the following. Continued thinking on unfavorable situations exerts a negative influence on the athlete owing to the signal function, and hinders a successful realization of his strengths and capabilities. On the other hand, fixing the consciousness on favorable things helps one attain success, for the same reason.

Conversations with athletes indicated that in many cases they overcame pre-race undesirable conditions. Along with the use of various types of warmup, breathing exercises, etc., they believe that a change in the trend of thinking plays a significant role.

For example, having competed unsuccessfully in the 2nd Spartakiad of USSR countries, the marathoner decided to run well in the traditional Pushkin-Leningrad race. However, he couldn't shake the idea that the factors which prevented him from doing well in the Spartakiad could also occur in this race. The result of this was a nervous condition which he tried to overcome, reprimanding himself and telling his associated that he didn't plan on success, but wanted only to check himself. This was a trial method to enable him to overcome the pre-race nervousness. From the point of view of the signal function of his consciousness, this method can be explained in the following way: by excluding from the sphere of thinking those thoughts that concern the necessity of winning and the related extreme gathering of strength, the stimulating action of these thoughts is removed.

An exceptional calmness, a sluggishness prior to competition, is also an unfavorable pre-race condition. In order to overcome this pre-race sluggishness, the sprinter mentioned above and a shot putter along with the warmup and breathing exercises, attempted to concentrate on

the mobilizing factors (the necessity of winning, the unpleasant after-affects of losing, picturing the running of the race itself or of the putting of the shot, etc.). By doing this they bring into play those factors which influence the organism in a favorable manner prior to competition.

The thoughts of the athlete during the competition itself play a similar role. This is upheld by analyzing the behavior of athletes and their thoughts and experiences during competition. Consider a case which happened in the marathon at the Central Soviet "Dynamo" championships in Kishinev during the autumn of 1959.

One of the participating marathoners said: "After the start, when the runners had broken up into little groups corresponding to their abilities and tactical plans, I found myself in the third group, in which I ran for 15 kilometers (about 9¼ miles). Then I began to pick up the pace, in order to catch the leaders ahead. This I was able to do by about the 30 kilometer (about 18.6 miles) mark. However, due to the prolonged period of running at this accelerated pace (against the wind and in cold weather), my condition suddenly deteriorated. My legs absolutely refused to obey me, and I could hardly move them. In addition, an old injury began to make itself felt.

"In spite of the fact that I was at this time running in fourth place and there remained only about six kilometers (about 3¾ miles) to go, in my consciousness I didn't even entertain a glimmer of hope of successfully completing the race. In my mind was the thought that 'this is the end of my race; I can only walk.' At this critical moment one of my friends, a clubmate, caught up to me. 'I can't do it, Grisha, I'm going to walk,' I said to him. 'Hang on,' he answered, 'for me it is difficult also, but we must gather ourselves, because there is still a chance of making the combined Central Soviet team. There are four kilometers (about 2½ miles) left. Let's run together.' And I ran along with him. Seeing how my friend overcame his difficulties, I began to recover my spirits. His example, and also the reminder about the possibility of making the team and of the proximity of the finish, enabled me to resume the struggle. Running became easier. At this time (about 39-40 kilometers, about 24.2-24.8 miles) it became known that the leader had finished the race. This increased my strength still further. I picked up the pace and, leaving my friend, finished in third place."

From this case it is evident that when the athlete's condition reaches the critical stage, then of the sum total of his emotions, i.e. favorable (nearness of finish, actual chance of making the team) and unfavorable (heavy sentiments, sick feelings), the latter occupy the center of his attention. This led to a reduction of his activity. Switching the thoughts over to favorable factors led to a counteraction of this, and as we saw, helped him to realize that his capabilities were far from exhausted.

Hence it can be stated that our special investigation upheld the findings of Ozolin concerning the various effects of thoughts on the athlete's actions.

The theoretical propositions and the facts examined herein indicate the necessity of special psychological preparations for athletes before competition. In particular, such preparation sets up in the athletes definite thinking patterns which stimulates them in the active struggle for their best performance during competition.

It is advisable to talk over with the athletes examples from sport of the negative after-effects of defeatist thinking, and to extablish in them a belief in a favorable outcome of the competitive struggle, even against the strongest opponents. It is necessary to develop in the athlete the ability to evaluate soberly his capabilities, to appraise objectively the strongest and the particularly vulnerable opponents, expecially in the light of their condition. Such an appraisal is one of the necessary and important requirements for working out tactical plans against the opposition.

It is necessary to direct the pre-race thinking of the athletes in such a way that they won't think of the results which they must attain or of the importance attached to the outcome (the athlete is quite familiar with these), but rather of how best to attain their goals, i.e. the tactical-technical aspect and the particular motions involved. One should therefore attempt to distract the athlete from obsessed thinking of the results of the competition at hand. On the day before the competition, this can be done by strolls, trips out of town, visits to a theater, movie, etc. On the day of competition and just before the start it can be accomplished by means of distracting and encouraging conversations and by the warmup.

(Reprinted from "Track & Field," No. 9 (Sept.), 1960, Moscow, pp. 16-17.)
(The above article was translated from Russian by Gar Williams.)

Training Can Be Overdone

by John Bowman

In recent years the importance of hard physical training in the preparation of an athlete has become generally recognized. This is based on the principle that the more hard physical training one puts in, the more one will take out in athletic performance, and is true up to a point.

It must be recognized from the beginning that physical types and muscles vary, that each physical type and each muscle has a maximum in both power and endurance, which will be reached by hard physical training and no amount of additional hard work will increase this maximal level. True, constant repetition of a hard training routine will keep the athlete at his highest level of performance and, what is important, increase his rate of recovery between events.

Let us take such a training routine for a man or woman having reached maturity:

A training program is arranged.

The basis of the training sessions will be hard physical work, culminating at the peak--in both power and endurance--of which the athlete is capable of at this time. This will be followed by a suitable period of rest to allow complete recovery or until the athlete expresses a complete feeling of well being, when the next session will be carried out. Each succeeding session will be increased in strength and duration and the athlete will find he needs a shorter rest between each as time goes on.

Eventually a stage will be reached when the performer's maximal strength and duration level have been attained. Once this standard is achieved the athlete should now endeavor to keep his training sessions in tune with the standard of his last few outings, for these are the ones that time has shown will give him the best returns.

These principles are carried out in the re-education of muscles after injury. A program is set where the patient reaches his maximum in both power and endurance, a suitable rest is allowed and the exercises repeated. No matter how weak the muscle is to begin with, it will quickly thrive under this technique and on an average somewhere around the three month stage it will reach its maximal degree in both power and duration.

But, let me repeat, every muscle has a maximum in both these factors, and the continuance of a maximal training program from then on will only increase the rate of recovery after exercise or training in general, which, in itself, is very important in a competitive sport.

It is essential that each individual performer must come to recognize his own maximal training level and not be misguided into following another athlete who has a far greater capacity for hard physical training. This will only result in him attempting a training period far in excess of his maximal ability, the outcome of which will be an unnecessary amount of body wear and rear. Moreover, he might develop an inferiority complex because of his inability to carry out some of these very hard training sessions.

Let us not forget that power and endurance are not the only factors in making a successful athlete. This was also clearly demonstrated at Vancouver in the classic race between Roger Bannister and John Landy.

Landy is well known for his hard physical training spells, yet he was second. But had they raced again the next day my money would have been on Landy, for his hard training routine had given him a very rapid recovery rate.

There is no doubt that athletes in the past did not train enough, but we must certainly not go to the other extreme, for in the long run it will be just as bad.

(Reprinted from THE MODERN ATHLETE, Vol. III, No. 2, page 6, May-June, 1955).

For years men tried to run the mile in less than 4 minutes. One finally did. A man no longer of limb, stronger of heart, sounder of wind than those who tried and failed before him. What special gift favored him? The quality of mind that said it could be done! Life's prizes are not won by those who merely possess nature's gifts. They to to those with the will to win.

Pole Vault Questions & Answers

We are indebted to English Chief National Coach Geoffrey Dyson for the AAA Honorary Senior Coaching Award questions for 1960. These are answered by Fred Housden, mathematician and leading English Pole Vault authority, at the specific request of TRACK TECHNIQUE.

(Note - in all these answers a left-foot take-off is assumed.)

Question 1. "The vaulter should attempt to eliminate the swing if possible; of course, this can't be done, but the vaulter should try and get into position for the pull-up as soon as possible". (Sefton). Discuss this statement.

I agree with Sefton that it is not possible to eliminate the "swing" in a vault and I assume that by "pull-up" he means exerting force by decreasing the angle formed by fore-arm and upper-arm. We will assume that the vaulter is just making ground-contact with his take-off foot. At this moment the pole should have firm contact with the back of the box and the pole should be completely in front of the athlete, whose hands will be some 4 inches (10 cm) in front of his head. The athlete wishes to do two things, (1) to raise his center of gravity as high as possible consistent with his desire to cross the bar, (2) to move the pole to a near vertical position to enable him to control his movements at the top of his flight. When the athlete has left the ground the forces exerted by his hands on the pole act at an angle to the pole and will so act until his center of gravity has reached the line of the pole. As these forces tend to slow down the pole's upward movement, the athlete should not increase them by starting to raise his legs too early. However, as soon as his body weight reaches the line of the pole, these forces will act down the pole and any increase in their strength cannot have any effect on the upward rotation of the pole. All this time the man and pole are rotating about the base of the pole, i.e. its lowest point. The nearer their center of gravity is to this point the faster will be the rotation. As soon as the athlete raises his center of gravity by rolling his knees up to his chest, this rotation will be slowed down. These two considerations demonstrate the importance of the "swing" of the body up to the pole.

At take-off the athlete should strive to drive his chest and pole upwards, in other words the drive of his take-off foot should be downwards in order to obtain the maximum upthrust from the ground. At this moment his hands are rotating about the base of the pole, which means that their forwards speed has been reduced; his take-off foot is stationary as it is in contact with the ground; his hips are free to move forward, their movement only limited because they are restrained by other parts of his body. Provided the athlete looks upwards at take-off, these three facts show that he will leave the ground with a hollow back. The reaction to this upthrust and a high lift of the thigh of the free leg will be relaxation of the body from the hips downwards, and the athlete will need time to regain control before starting to raise his legs. A good spring up from the ground will usually result in an efficient "swing" as the athlete will be unable to start to raise his legs until his center of gravity is lying almost in the line of the pole. In this sense an athlete may be said to endeavour to "eliminate the swing" because he starts to raise his legs as soon as he possibly can.

Once the athlete's center of gravity has reached the line of the pole, he must act explosively and, breaking at the hips, roll up his knees to his chest, raising his hips to a slighter level than his shoulders. From this position he is able to exert his pull-up effectively. The athlete should realize that the raising of the legs, the pull-up and the push are parts of a vigorous, explosive, continuous heave. This heave ends the swing as the body comes into alignment with the pole. Any tendency for the legs to swing past the pole must be eliminated. Of course the legs will pass the pole but this should be due to the heave. The athlete must develop sufficient strength to raise his legs really fast; "he must endeavour to get into position for the pull-up as soon as possible".

Question 2. List six principle faults in this event and describe how you have attempted to correct them in coaching.

Fault (1) Failure to place the take-off foot on the line of running, i.e. directly under the pole, assuming that the pole is correctly planted.

Remedy - Place a white card over part of the offending impression of the take-off foot on the runway. Most athletes will automatically place the take-off foot to the correct side of this card. The card can be placed nearer and nearer to the central position for successive vaults until a correct take-off position is obtained. It is important that movements of the card whould be gradual.

Fault (2) Lateness in planting the pole using the "under arm" method.

Remedy - Practice planting the pole from a two stride approach, stressing the upper-out movement of the right hand, i.e. the hand moves from the side at about hip level to some four inches in front of the top of the head, keeping close to the athlete's body during this movement. The athlete must build into himself the sensation of having the pole in front of him before he actually springs up at the take-off. After this exercise he should return to his normal approach run, concentrating on having the pole directly in front at take-off. (He must start to plant early in order to achieve this position. I have found that to advise the athlete to start his plant at a certain point in his run-up leads to hesitation in the last two strides. On the other hand, if he concentrates on the pole position directly to his front, he will start to plant at the correct position in his run-up.)

Fault (3) Swing too short.

Remedy - Stress the upward spring at take-off (see answer to question 1). If this fails to produce a longer swing, advise the athlete definitely to delay starting his leg-lift but insist on a very fast roll-up of the legs.

I always hope that the first method will cure the fault as delaying the leg lift often leads to the legs swinging well beyond the pole. Of course, a short swing will always result from a take-off which is too near the box, but I am assuming that the athlete has his take-off foot correctly placed.

Fault (4) Failure to make a correct hand shift at take-off.

Remedy - Insist on relaxed approach run; make the athlete hold the pole very lightly with his left hand, using only thumb and first finger.

Fault (5) Knees not rolled up to chest to get into position for the pull.

Remedy - This fault is usually a matter of lack of strength. Give the athlete exercises to strengthen his shoulders, back and abdominal muscles. A good exercise on a rope is - hands near together - hang full stretch - roll-up fast so that the hips are higher than the shoulders without bending the arms; repeat in sets of six.

Fault (6) Thrusting horizontally across the bar.

Remedy - Concentrate on driving the right leg vertically in the pull-push movement and throwing the head and shoulders back, allowing the left leg to relax and counteract as it will. This is a somewhat frightening experience, so practice on a rope or horizontal bar to gain confidence. From a full hang position - a fast roll-up of the legs, immediately followed by a vigorous pull-up, during which the right leg is stretched vertically upwards and the head and shoulders are thrown back. This will give the athlete a near vertical hollow back position. No attempt should be made to drive the left leg upwards, it must be relaxed as the right leg is stretched.

Be sure that the athlete takes the pole with him at the top of his flight. He must pull the pole into his shoulder after the pull and stretch.

Question 3. Write short notes, giving your views, on: (a) The placement of pole vault standards. (b) The advisability of accentuating the foot-stamp or spring at take-off. (c) A comparison of arch, fly-away and jack-knifing clearance methods.

(a) The placement of the pole vault standards, at any rate for the less advanced vaulter, will be different in practice than in competition. In competition the objective is to clear the bar and the standards must be placed to position the bar to accord with the form the athlete is showing. In practice it is advisable to have the bar 12 (30cm) inches on the landing area side of the back of the box or even 18 (46cm) inches. This placement of the standards should ensure that any clearance of the bar results from a near vertical position of the pole, a point of technique fundamental to efficient vaulting.

Top class vaulters will position the bar in accordance with their personal technique. Usually the higher the bar the nearer the bar will be to the back of the box. Some vaulters have used a bar position a few inches on the runway side of the back of the box.

(b) The athlete acquires all the horizontal speed he can manage in his run-up. Consequently I would advise him to develop as much spring as possible in his take-off. As the foot is placed on the ground in front of the athlete, the take-off must be a heel-toe movement, which is essential to spring. At the same time the right thigh is moved vigorously upwards, so increasing the lift. Besides assisting in lifting man and pole this accent on spring causes the body to relax from the hips downwards immediately after take-off, resulting in a smooth swing of the body up to the line of the pole. This action also prevents any tendency of either foot to move in front of the hips as

soon as it leaves the ground, which action would cause a loss of efficiency in the swing.

(c) The jack-knife clearance requires the body to pike almost as soon as the feet reach bar level.

The fly-away is obtained by projecting the body across the bar at a considerable angle to the vertical, say 30 degrees, in a hollow back position.

The arch clearance is obtained by the trunk and right leg being thrust vertically upwards by the final push action on the pole. Of these three methods of leaving the pole, the arch clearance will project the athlete's center of gravity to the greatest distance above his handgrip, and for this reason I prefer it. The actual crossing of the bar is obtained by the right leg folding back from the knee automatically after its vigorous stretch upwards and the left leg rotating downwards from the hip. These downward movements assist the upward movement of the trunk and shoulders and enable the hips to cross the bar. Next, arms and shoulders are lifted and the head is thrown back, the legs swinging back in a normal reaction putting the athlete into a hollow back position as his chest clears the bar.

A Cost-Free All Weather Track

The running track at Turku, Finland, composed of the traditional cinders and clay, has for many years been regarded as perhaps the fastest in Europe, if not the world. To make this track even faster, groundskeeper Paavo Karikko (one of Finland's excellent coaches) gives this track a special oil treatment immediately following the close of the racing season each Autumn. This results in an all-weather running surface.

The two inside lanes are covered with used crank case oil (used motor oil) from automobiles. Such used oil is obtained free of charge, since it would otherwise be thrown away. This oil is poured on the track until it reaches a thickness (or depth) of one inch. It is allowed to filter into the track throughout the winter. By Spring, with the beginning of the racing season, the oil has disappeared into the track, and an all-weather surface remains. This surface requires a minimum of maintenance, regardless of weather or use.

Karikko is of the opinion that through trial and error on experimental plots, groundskeepers in other climates may readily determine the appropriate amount of oil to pour on cinder tracks, and the proper length of time to permit this oil to be absorbed prior to use.

Traditionally the finest running tracks have been composed of various mixtures of clay and cinders (or ground firebrick, etc). During the recent past several tracks made of fibrous asphalt composition (produced under the trade name "Grasstex," manufactured by the American Bitumuls & Asphalt Co., of San Francisco, California) or rubberized surface composition (produced under the trade name "Perma-track" and "Saf-Pla", manufactured by the U.S. Reclaiming Rubber Company) have been constructed in the U.S.A. Such tracks (and runways) are an all-weather surface which is smooth, resilient, stable, attractive, safe, fast, and durable; and they reduce maintenance to a minimum.

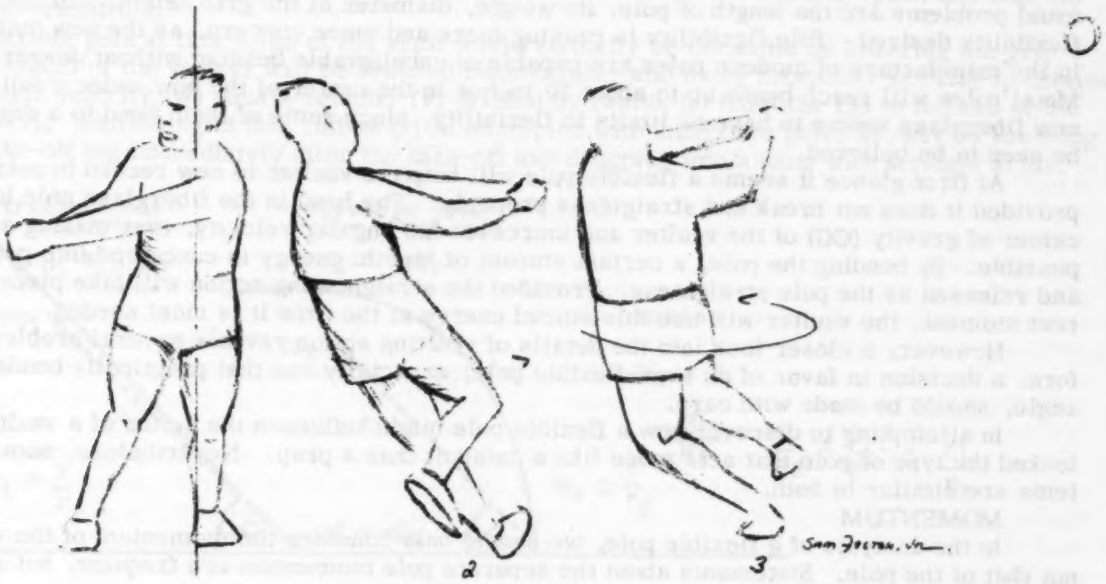
The initial cost of an all-weather track of this type is quite high, although when calculated on a long-term basis in consideration of reduced maintenance costs, such a track appears reasonable and economical.

For clubs, schools, universities, and institutions desiring such an all-weather track but unable to pay the initial cost, this news from Finland may offer a welcome solution in providing a "cost-free" all-weather track!

"Today's sport is much more of an intellectual exercise. While trying to protect yourself, you are testing, trying your opponent. You are investigating his problems, his attitudes, his favorite actions. You have a limited time in which to decipher him. It's like a chess game in rapid action." (Irving De Koff, quoted in TIME)

Hammer Notes

(First in a series by Sam Felton, Jr., fourth placer in the 1948 Olympics.)



START OF EACH TURN

1. Eyes and upper body to your right, facing general direction of the hammer. Body weight primarily over left foot.

2. Drive your body (particularly hips and legs) way around left. Spin on the outside of left foot. Feel tight hammer wire (don't let it go slack). Keep right foot on ground as long as possible.

3. While hanging from the hammer (2), throw entire body around left side so you will complete turn with weight still on left foot. During this motion, hammer wire must become tighter and tighter as you hang from it with increasing force.

4. Don't pick right foot up--let it be pulled from the ground as you fling yourself into the turn.

5. Don't lift your arms at any point--try to let them remain in the same position relative to your chest all throughout the turns--let them rise only as they have to, that is, from the pull of the hammer.

6. Keep hammer plane low at all times.

7. Don't pull hammer with arms. Instead, throw your body around left leg with more force and pick up speed by hanging harder against hammer. Speed comes from countering the pull of the hammer with entire body at right time.

Dr. Hans Kraus, Associate Professor of Physical Medicine and Rehabilitation at New York University, found that physically inactive people are more likely to suffer from organic troubles, diabetes and psychiatric illness than physically active people. He came to the conclusion that physically active people suffer less and live longer, and he advises doctors to prescribe physical exercises together with pills to keep their patients healthy. (Reprinted from "Vigor" magazine, Vol. VIII, No. 3, June, 1955, page 36)

Pole Vault Problems Created by Using Fiberglass Poles

by "Jess" L. Jarver, Adelaide, Australia

The choice of a suitable pole is often a rather complicated tast for pole vaulters. Among the usual problems are the length of pole, its weight, diameter at the grip height, and the degree of flexibility desired. Pole flexibility is causing more and more concern, as the new materials used in the manufacture of modern poles are capable of unbelievable bending without danger of breaking. Metal poles will reach bends up to about 30 inches in the center of the bow under a full load. The new fiberglass seems to have no limits in flexibility, since some of them bend to a degree that must be seen to be believed.

At first glance it seems a flexible pole will help the vaulter to new record breaking heights, provided it does not break and straightens properly. The bend in the fiberglass pole lowers the center of gravity (CG) of the vaulter and increases his angular velocity, thus making a higher grip possible. By bending the pole, a certain amount of kinetic energy is concerted into potential energy and released as the pole straightens. Provided the straightening action will take place at the correct moment, the vaulter will use this stored energy at the time it is most needed.

However, a closer look into the details of vaulting action reveals several problems. Therefore, a decision in favor of an over-flexible pole, expecially one that practically bends to a right angle, should be made with care.

In attempting to discover how a flexible pole might influence the action of a vault, I have overlooked the type of pole that acts more like a catapult than a prop. Nevertheless, some of the problems are similar to both.

MOMENTUM

In the analysis of a flexible pole, we should only consider the momentum of the vaulter, and not that of the pole. Statements about the separate pole momentum are frequent, but always somehow confusing.

The kinetic energy of the vaulter is equal to half of his weight times velocity squared ($KE-\frac{1}{2}mV^2$). Exactly the same applies to the pole that is moving with the vaulter in the same running direction. Since the velocities of both the vaulter and the pole are equal, we are only concerned with their masses. For example, in the case of a vaulter using a 5 lb. (2.27kg) pole whose body weight is 150 lbs. (68kg), the ratio of the two masses (and also the two momentums) is one to thirty (1/30) at the approach.

At the moment when the pole is planted, a loss in pole momentum occurs. Only one-third of the original momentum remains when planted at an angle of approximately 20 degrees. A 30 degree angle will conserve about one-half of the useful momentum. The effective ratio is 1/90 for a 20 degree plant, and 1/60 for a 30 degree plant. This is almost negligible, and its contribution may be regarded as nil (see Diagram 1).

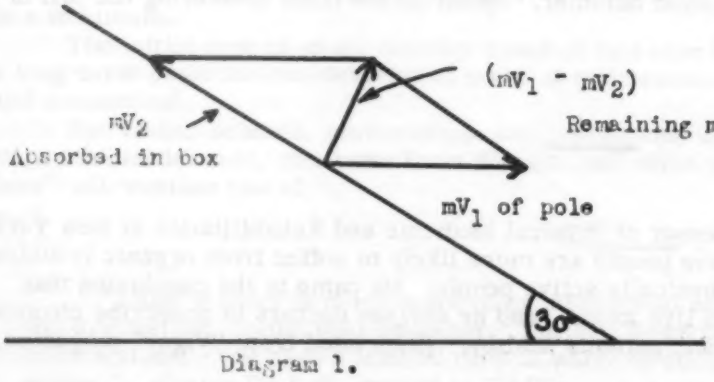


Diagram 1.

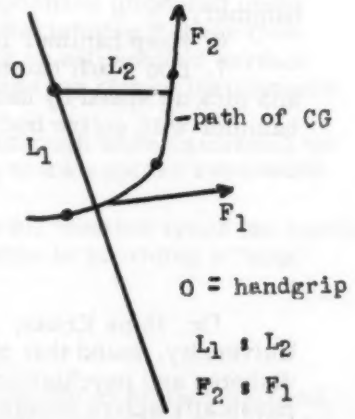


Diagram 3.

FLEXIBLE POLES INCREASE ANGULAR VELOCITY

During the take-off phase the vaulter's translational (horizontal)motion is changed into rotating movement. This transition from translational velocity (V) to angular velocity (W) is related W=V/r radians/sec. The vaulter seeks to utilize his horizontal (translational) momentum, and conserve whatever angular (rotating) momentum which remains from his running speed and take-off action after transition.

A flexible pole at this stage of the vault would virtually be the same as lowering the grip height. The CG of the vaulter will be lowered considerably and more rotational velocity is obtained since angular velocity (W) equals velocity (V) divided by radius (r) from the CG to the end of the pole (W=V/r). Shortening of this radius (r) is attempted with unflexible poles anyway by lowering the non take-off leg immediately after the take-off and dropping into a hang with straight arms.

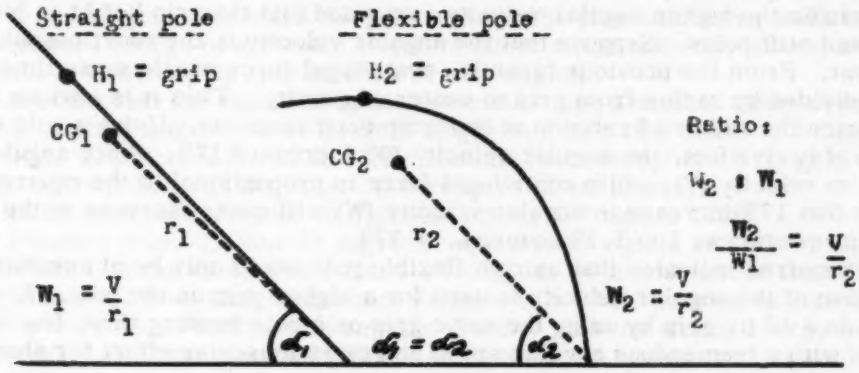


Diagram 2.

As the angular velocity (W) is inversely proportional to the radius (r), a vaulter who grips the pole at 12 feet will shorten the effective radius from the handgrip to the end of the pole in the box and increase angular velocity as noted in the following table:

Bend in Pole	Effective grip	Percent increase in Angular Velocity with respect to non-flexible pole
6"	11' 11"	0.9%
1'	11' 9"	2.0%
1'6"	11' 6"	4.0%
2'	11' 2"	7.0%
2'6"	10' 7"	11.0%
3'	10' 0"	17.0%

The problem remains as to how the sudden bending of the pole immediately after the body weight has been transferred on the pole might affect the movement of the vaulter. A flexible pole will certainly soften some of the jerk received after the take-off, but having the effect of a very sudden lowering of the grip tends to cause a premature bending of the arms to counteract the drop. This in turn could cause an early pull-up action on a still bent pole and ruin the entire timing of the vault.

However, if we overlook this problem it seems obvious that during the long pendulum a flexible pole has great advantages. The more flexible the pole at take-off, the shorter the time of the swing (since angular velocity equals horizontal velocity divided by radius, and angular velocity has been increased when radius is decreased, as W=V/r). The flatter the movement of the CG of the vaulter, the less work has to be done against gravity.

At the same time it is necessary to keep in mind that a certain amount of kinetic energy is used bending the pole and converted into potential energy (similar to winding up a clock spring). In the following stages of the vault the vaulter anticipates the release of this stored energy at the moment when it is most needed.

MORE WORK IN THE SHORT SWING?

As soon as the legs pass the pole, the CG of the vaulter starts a more noticeable upward move. Work against gravity increases, the radius from the vaulter's CG to the end of the pole (in the box) lengthens, and deceleration of the pole begins.

This phase is the start of the short pendulum to create a more efficient centrifugal force. By decreasing the radius from the hand grip to the CG of the vaulter, the increased tangential velocity will now affect the work of gravity and conserve enough energy for the remainder of the vault (centrifugal force equals mass times tangential velocity squarted, divided by the radius of the rotating body).

While the pole reaches it maximum bend at this stage of the vault, the path of the CG relative to the handgrip is the same regardless of the degree of the pole bend, (See diagram 3). This would mean that the flexibility of the pole has no influence on the short pendulum, except for the problem as to how to handle the higher angular velocity, provided that the grip height is left the same on both flexible and stiff poles. Suppose that the angular velocity in the short pendulum were increased by ten percent. From the previous formula, centrifugal force equals mass times tangential velocity squared, divided by radius from grip to center of gravity. Thus it is obvious that the muscular effort to shorten the radius of rotation at handgrip must increase. Using a pole that bends three feet, with a grip of twelve feet, the angular velocity (W) increased 17%. Since angular velocity (W) is proportional to velocity (V), while centrifugal force is proportional to the square of the velocity (V), it follows that 17% increase in angular velocity (W) will cause increase in the muscular effort in the same proportion as 1 to 1.17 squared, or 37%.

This extra work required indicates that using a flexible pole would only be of assistance to the vaulter when the increase of the angular velocity is used for a higher grip on the pole. A vaulter who normally depends on a 12 ft. grip by using the same grip on a pole bending three feet would find himself confronted with a tremendous angular speed and extra muscular effort for shortening his swimg.

PULL-UP NEEDS STRAIGHT POLE

During the latter part of the short pendulum the pull-up action starts and it is here that the flexibility of the pole has to be considered as it necessary for the pulling force to be directed along the line of a straight pole. Any bend in the pole at this stage considerably subtracts from the pulling force.

The ideal pulling force should be along the line with the pole and parallel to the centrifugal force created by the pendulum. In diagram 4, figures 1-3, it is obvious that an incorrectly timed pull will reduce its effect. This could happen with a pole which has not straightened at the correct time. Fig. 1 indicated the ideal pull with parallel forces. Figures 2 and 3 show the pull-up (F_H) and centrifugal force (F_2) decrease the combined force (F_R). F_R equals F_H plus F_2 (Cos. θ). That symbol is THETA in triginometry.

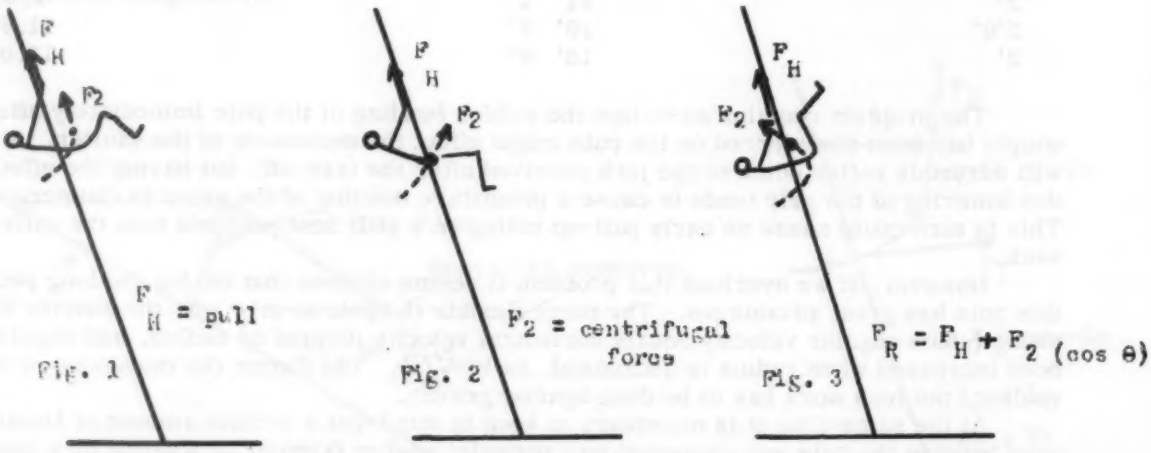


Diagram 4.

The kinetic energy converted into potential energy will be released at this stage of the vault after the vaulter's CG has passed the pole and the pole will straighten. This straightening will suddenly move the vaulter close to the bar and will considerably shorten the time left for the turn and bar clearance movements. Delayed pulling action will bring the vaulter to a position similar to fig. 3 in diagram 4, and not only would he have to hurry the remainder of the vault, but also lose some of his pulling force. An earlier pull up would be directed along a pole which is still bent.

HIGHER GRIP ON FLEXIBLE POLES

From the previous discussions it seems reasonable to assume that a flexible pole will be of an advantage only when a higher grip is used. Exactly how much the grip should be raised depends on the degree of flexibility and the amount of momentum lost at the take-off because of a higher grip.

A higher grip decreases the pole angle at the plant and extra work is required to overcome the increased change of direction (relative effort at the take-off, among other factors, being proportional to 1 divided by sine function of pole angle).

Assume that the approach speed is constant and a vaulter using an unflexible pole with a 12 ft. grip height changes to a 13 ft. grip height on a pole that bends to a degree where the effective grip height is shortened to 12 ft. Also assume that the higher 13 ft. grip changed the angle of the pole at take-off 36 to 33 degrees. The relative effort is now:

Unflexible pole: 1/ Sine 36 degrees equals 1.7 equals 100%

Flexible pole: 1/ Sine 33 degrees equals 1.87 equals 107.5%

This means that the vaulter now faces a 7.5% loss of momentum at the take-off, but at the same time gains a 8.3% angular momentum relative to a 13 ft. grip on an unflexible pole. His net gain will be a very slight increase in angular velocity plus the stored energy in the pole bend that will lift his CG 12" at the moment the pole straightens.

There is natually a limit in raising the grip height and as the angle of the pole decreases the loss of momentum at the take-off will reach a point where the loss of angular momentum will be restricted to a degree where the pole will not reach a near vertical position.

SUMMARY

We can now sum up the situation in favor of a flexible pole because it permits

1. An increased grip height.
2. Stored potential energy.

At the same time we must consider that: 1. The higher grip will reduce momentum at the take-off.

2. The sudden bending of the pole when body weight is transferred might have influence on vaulters movements.

3. The late straightening of the pole might reduce the use of the stored energy to full advantage.

A flexible pole will therefore be successful only with an exact timing of the vault. The last stages are most complicated as the suddenly released energy will move the vaulter very fast towards the bar. Inconsistent performances caused by small errors in timing could result, and as the flexibility increases perfect vaults can only be achieved with extremely accurate timing.

A pole that bends nearly to right angles would mean that the vaulter merely hangs on to the pole and lets it catapult himself over the bar without worrying about the presently accepted movements of technique. In this case most of the art of pole vaulting will be lost.

Explanation of symbols: CG= Center of gravity. m= mass. V= velocity of long pendulum. r= radius of long pendulum. = angle between horizontal and the radius. W= Angular velocity (time rate of change of the angle). L= radius of the short pendulum (distance from handgrip to vaulter's CG.

"Now! now," cried the Queen, "Faster, faster!"- Through the Looking Glass.

"Now, here, you see, it takes all the running you can do, to keep in the same place."
-Through the Looking Glass.

The Athlete & Adaptation to Stress -Part 1

(First in a series of three articles.)

by Forbes Carlile, Australia

The training of athletes for strenuous physical activity today is much an art and less a science. We lack too many basic facts about the effects of muscular exercise on the human organism even for the most modern training regimes to be called scientific. Personal judgment, opinion, authority and sheer enthusiasm continue to play nearly as important a part in "producing" the champion, as in the earliest days of modern competitive running when Walter George of England, as far back as 1886, ran the mile in 4 minutes $12\frac{3}{4}$ seconds.

The modern textbook on coaching methods tells next to nothing of a scientific nature of how to train the body--functions for speed and endurance. What solid facts are there to enable us to do little more than guess why one athlete makes his record time while another, working to exactly the same training program my fail to perform even near his best? As Professor A.V. Hill says[1] in his article in the Encyclopaedia Britannica, "there is very little physiological knowledge about the changes which come over the body in physical training".

The guiding lights for many coaches have been the methods used by the reigning champion and the most successful trainers. Occasionally with imitation, real progress seems to have been made. For instance it is now generally accepted that an athlete for maximum possible performance must train for hours rather than minutes a day, and the "fast-slow" training principles first used by the Swedish runners in the 1930's is now widely and successfully practiced in many sports. But whether the improvement in standards is due to new methods or greater world-wide interest and participation, one can do little more than guess. Methods of training have not yet been evaluated scientifically.

It is not difficult to find the reason for the lack of knowledge about training, for the human body is a complex organism with what seems countless known physiological, psychological and social factors, acting and interacting. It is difficult and time consuming to make well-controlled experiments, holding enough variable factors constant, in order to come to many definite conclusions. Since modern civilized society holds the opinion that to strive for athletic honors is a worthy goal for some of its members, there is good reason for the scientist being curious about basic principles governing strenuous physical performances. There will have to be observation and experiment with the whole athlete directly in his particular specialized sphere of physical performance, if there is going to be real progress in solving the problem of how to train an athlete to perform his best.

While he should be aware of our general lack of insight into training mechanisms, he will make a poor coach who has no basic philosophy to guide his teaching. The purpose of this paper is to propose the acceptance of the General Adaptation Syndrome theory of Hans Selye as a scientific basic philosophy to guide the coach. Whether he believes that the more training the athlete does the better the eventual performance will be, or that it is not so much a question of how much but how the training is done, the present author suggests that the Selye "Stress" concept will provide the framework of a sound theory for future scientific observation and research in training.

The author suggests that a more general understanding of the Stress and Adaptation energy concept will prevent the waste of much athletic talent and hence add in some measure to the sum total of human happiness.

The Selye hypothesis of the General Adaptation Syndrome has important implications in the field of medicine, but it would appear to the present author that a knowledge of the G.A.S. and its implications will result in the gain of considerable insight to the coach who stresses his charges with physical exercise.

THE STRESS CONCEPT

It has been accepted for some time that internal and external bodily stress plays an important part in determining the health of man. Long before Selye commenced to document with sound experimental evidence, it was widely realized that assaults by physical violence, microbes and disease, climatic conditions and nervous tension constitute the common human stresses. As Stewart Wolf[2], a famous New York psychiatrist, has pointed out, nervous strain represented by threats and conflicts, real or imaginary, conscious or unconscious, constitute a large portion of the stress to which man is continually exposed.

There is now a considerable body of evidence showing the close relationship between bodily stress and disease, and general malfunction of the bodily processes. Many biological mechanisms are involved in the stress response.

Many workers have contributed to this Stress concept, particularly in regard to the effect of the emotions on bodily disease, but Selye[3], experimenting mainly with rats, rabbits and guinea pigs, has been able to throw considerable light on definite reproducible effects of a wide variety of stresses on the animal organism. His research has taught us something of the mechanism of physical and mental stress by which bodily changes are brought about. Selye spotlighted the anterior pituitary and adrenal endocrine glands as playing parts in what he called the General Adaptation Syndrome. He emphasizes the role of the hormones but many of Selye's critics believe that he over-emphasizes the differential effect of hormones in the stress response. In this paper we shall concern ourselves with Selye's proposition about which there is very little argument, the General Adaptation Syndrome.

THE GENERAL ADAPTATION SYNDROME

Selye has shown that such stressing agents as infections, poisons, trauma from burns or mechanical damage, heat cold, starvation and muscular fatigue as well as having their own quite definite specific actions on parts of the organism have invariably, generalized and stereotyped non-specific effects on the body, superimposed upon all the specific effects.

The outstanding effects of prolonged stress which Selye reported [5, 6, 7] were:--(1) Enlargement of the adrenal cortex and cellular changes there indicative of increased glandular activity. (II) General atrophy of the lymph glands with concomitant changes in the blood cell count, particularly in respect of eosinophils and lymphocytes. (III) Erosions and ulcers in the gastro-intestinal tract.

These changes and others are characteristic of what Selye names the General Adaptation Syndrome (the G.A.S.).

Under the influence of various stressing agents, including muscular exertion which can be an important stressor, the body changes in such a way as to adapt itself. According to Selye this adaptation can be differentiated into three states:--(i) The Alarm Reaction. (ii) The State of Resistance. (iii) The Stage of Exhaustion.

The alarm reaction is sub-divided into two stages, shock and counter-shock. Shock represents the organism's initial response to a sudden exposure to stimuli to which the organism is either quantitatively or qualitatively not adapted. For example, an animal may be in a state of training for muscular exercise. Running on a treadmill for five minutes may cause a very mild G.A.S. while the untrained litter mate may show a marked response on stopping. But provided the stress is severe enough even if trained to withstand it, the animal will show some alarm reaction changes.

The changes of shock include diminished blood pressure, loss of muscle tone, a sustained very high heart rate and gastro-intestinal ulceration if the stress is very severe. However, with mild stresses, and exercise usually only acts as a mild stress, the main signs are merely transient high heart rate and some chemical and cellular changes in the constitution of the blood.

As Selye pointed out, muscular exercise as a stress gives a minimum of shock and a maximum of counter-shock. Exercise causing very little tissue damage precipitates an almost pure G.A.S. response.

In the stage of counter-shock the physiological changes of shock become generally reversed, e.g., blood pressure rises above normal, and soon it seems that the adaptive mechanisms in the body are proceeding at a greater rate than the destructive processes. Adaptation may be defined as being a state of the organism characterised by an increased resistance to stress through previous exposure to stress.

During the increased rate of adaptive processes of counter-shock the organism becomes active, shows evidence of increased psychic stimulation, and there are noticed activities indicating a sense of well being. Physiological changes including lymph gland atrophy and a lowered eosinophil cell blood count occur.

Resistance to all stress, including the stress which precipitated the reaction, is low during shock but during counter-shock resistance to all stresses is increased. However, the protection, called cross-resistance, of the counter-shock reaction is temporary. If the precipitating stress is

continued, more or less unchanged, the animal goes into what Selye calls the Stage of Resistance when there is increased resistance only for that stress, and decreased resistance for all other stresses. The stage of resistance may be defined as the sum of all the non-specific reactions brought about by prolonged stimuli to which the organism has acquired adaptation.

In the stage of resistance the organism will continue to resist the original stressing agent but the animal becomes more vulnerable to other stresses which in addition to the original stress if severe enough, may each be capable of producing an Alarm Reaction super-imposed physiologically on the Resistance reactions.

The final stage of the G.A.S. is the Stage of Exhaustion, which represents the non-specific reactions resulting from prolonged overexposure to which adaptation has been developed but can no longer be maintained.

During the Exhaustion Stage, resistance to all stressing agents is lowered and any stress will precipitate a violent reaction of prolonged shock and death.

The passage of the animal from one stage into another is usually a gradual one and it is not always easy when specific effects of the particular stressing agent are evident, to recognize the stage. There seems little doubt, both experimentally and in practice, that resistance to all stresses decreases gradually as the Exhaustion Stage is approached.

Selye pointed out many times in his papers that we know practically nothing about the physiological changes occurring as the animal progresses from a state of resistance towards exhaustion. We know even less about human responses.

By way of general illustration of the G.A.S. response to cold as a stressing agent it may be of interest to re-tell Selye's story[8] of what happened to mice when taken from mild room temperature and placed in a freezing chamber.

When taken from the room at about 70^{o}F. and placed in an environment at close to freezing point the mice at first became prostrated with shock. They then started to run about and carry on their normal activities, at first appearing over-active (the counter-shock phase) and then apparently passing into the State of Resistance when it was difficult to tell the difference between them and mice living under normal conditions.

After some hours, one by one the mice began to succumb, becoming sluggish in their activity and finally dying in shock.

Those that have observed athletes during training will by now be able to discern that the Selye "cap" fits in many places. The present author suggests that the athlete when trained hard almost invariably shows many responses of the G.A.S.

Selye postulated that the animal organism (including man) has a finite, limited adaptation energy. But as Selye points out this concept is an abstraction insofar as we do not yet know the exact nature of Adaptation Energy. All we can say at present is that the body responds as though it has such a limited supply. The facts advanced by Selye, and the author's own observations on himself and other athletes who have been in severe training, supports the concept that stress effects are summated to draw on the limited adaptation energy.

When everything seems to be nearly equal some individuals can always be observed to be able to stand distinctly more training than others and continue to show improvement. Whatever may be the reason for this, whether it is because of hereditary constitutional differences or in the store of adaptation energy, the fact remains that only the naive coach would dispense a rigid system of written training instructions. Bitter experience has shown many times that what is one athlete's training "meat" might well be another's poison. An individual's Adaptation energy must be one of the first considerations.

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Pulled Muscles, Why?

by H. A. L. Chapman, National Coach for Scotland

An adequate warmup is intended to bring about a number of physiological changes, not the least of which is an increase of muscle temperature which will, of course, reduce or lower muscular viscosity, which in turn means that it will help the muscles concerned to contract and relax more easily, with less resistance, and more quickly, thus reducing the possibility of a muscle pull. The most important point to remember, however, is that external temperature, that is to say, the temperature of the weather, makes little or no difference to muscle temperature, so that although the weather be hot, as it was at the Olympics in Rome and Los Angeles, it makes no difference: muscle temperature still has to be increased as a result of warm up.

Many athletes misunderstand this point and think that because they feel warm, the muscle temperature has therefore gone up. This is not necessarily the case. In fact, more often than not, they feel warm because skin temperature has increased, whereas muscle temperature has altered imperceptibly, so the fact that Arthur Wint collapsed in a relay on a warm day signifies nothing.

There are other reasons for pulled muscles, quite apart from a lack of warming up. It is perhaps not as widely known as it should be that teeth requiring attention can be a cause of pulled muscles. If decay is not checked early, it will penetrate the center of the tooth wherein lies the nerve and bloodstream. The infection is then directly in the bloodstream, and poison will always strike at the athlete's weakness, which is naturally the most vulnerable spot. The toxic effect, therefore, can be considerable.

In the majority of cases of pulled muscles, it is the relaxing muscle and not the contracting one which is pulled. In view of this, therefore, it is difficult to see how an exaggerated forward lean has any direct application on muscle pulls.

(The above was extracted from a letter by Mr. Chapman which appeared in the May, 1961, Vol. 2, No. 3 issue of THE INTERNATIONAL ATHLETE, published in Glasgow, Scotland.)

Book Review

TRACK AND FIELD FOR BOYS

By Payton Jordan, with Marshall K. McClelland. Published by The Follett Publishing Company, Chicago, Illinois, 1960. pp. 128, Illustrated. $1.00.

Stanford University's eminent coach has filled an obvious gap in track and field literature in the USA by producing this excellent work for the benefit of boys of Elementary and Junior High School age. Written in language which youngsters can understand, the book covers running, jumping, and throwing events in the enthusiastic and inspirational style of one of America's finest coaches.

Book Review

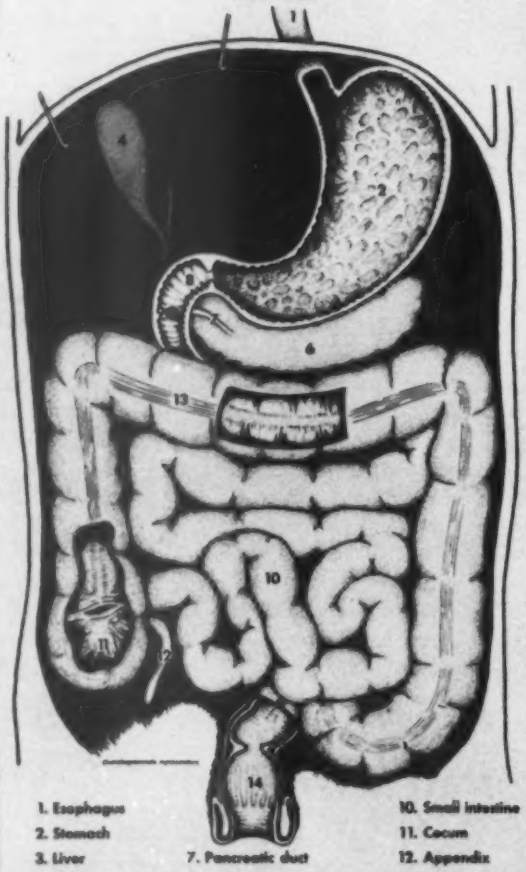
TRACK AND FIELD ATHLETICS

By George T. Bresnahan, W. W. Tuttle, and Francis X. Cretzmeyer. Published by the C. V. Mosby Co., St. Louis, Missouri. Fifth edition, 1960. pp. 538. $5.50.

Since 1937 when the first edition appeared, this book has justly acquired the reputation of being the standard American textbook in this sport. The fifth edition is obviously superior to its predecessors, as a result of including up-to-date technical data, and approaching workout procedures in terms of present-day training concepts. All events are covered except the triple-jump and hammer throw. Well illustrated, this book is highly recommended for the practical use of all track and field coaches.

ALIMENTARY SYSTEM

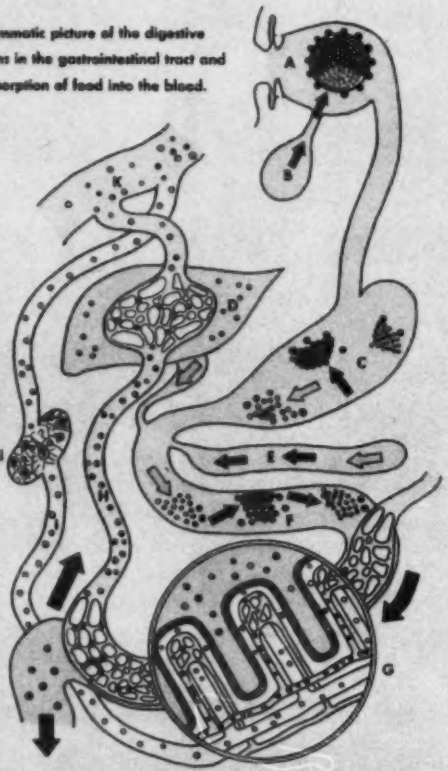
Structure



1. Esophagus
2. Stomach
3. Liver
4. Gall bladder
5. Bile duct
6. Pancreas
7. Pancreatic duct
8. Duodenum
9. Common outlet of bile and pancreatic duct
10. Small intestine
11. Cecum
12. Appendix
13. Large intestine
14. Rectum
15. Spleen

Function

Diagrammatic picture of the digestive functions in the gastrointestinal tract and the absorption of food into the blood.



● Carbohydrates ◆ Proteins ◆ Fats
◆ Carbohydrate-digesting enzymes ◆ Protein-digesting enzymes ◆ Fat-digesting enzymes • Waste

A. Mouth cavity
B. Salivary gland
C. Stomach
D. Liver
E. Pancreas
F. Small intestine
G. Microscopic cross-section of intestinal wall
H. Portal vein
I. Thoracic duct
J. Lymph nodes
K. Veins carry system

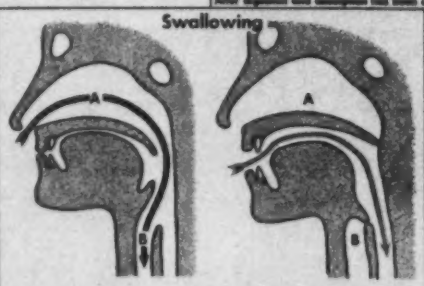
The food, composed of carbohydrates, proteins and fats is taken into the mouth. There it is minced and ground by the teeth and saliva is mixed with it. Here digestion begins. In the stomach and later in the small intestine all types of enzymes attack the food so that its constituents are broken down into elementary particles. Picture G shows how the individual food particles are absorbed into the blood and lymph capillaries of the intestinal villi. Carbohydrates and proteins are passed mainly into the blood vessels, fat particles into the lymph capillaries. Part of the food absorbed into the blood is stored in the liver. The rest passes through the liver into the main blood circulation. The fat also passes into the main blood circulation through lymph nodes and the thoracic duct.
After digestion and absorption has been completed, only waste remains in the intestinal tract.

Teeth

The permanent teeth are shown as they are embedded in the maxilla and mandible.

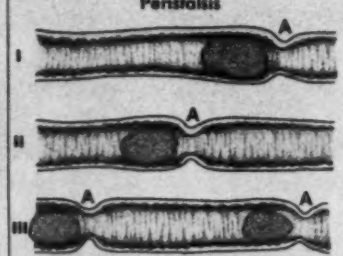
1. Incisors
2. Cuspids
3. Bicuspids
4. Molars

Swallowing



In the right figure the act of swallowing is shown when the food passes from the mouth into the esophagus. The nasal cavity (A) and Larynx (B) are closed under such conditions. When we breathe, mouth is normally closed; nasal cavity and larynx are open (left).

Peristalsis



The movement of the intestines by which the food is carried forward in the gastro-intestinal tract is called peristalsis. A ring of contraction (A) travelling along the intestinal wall keeps pushing the intestinal contents forward. Pictures I, II, and III show peristalsis in various stages.

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Chart reproduced courtesy of A. J. Nystrom Co. (Graphic Health Charts)